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[OFFICIAL NOTICE.]

Twenty-Third Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY.
NEW ALBANY, IND., April 9, 1900.

The twenty-third annual meeting of the Western Gas Association will be held in Chicago, May 16, 17 and 18, 1900, and will be called to order by the President, Mr. Wm. McDonald, of Albany, N. Y., at 9:30 A. M., Wednesday, May 16th.

The Auditorium Hotel has been selected as headquarters, and the meetings will be held in a suitable room contained therein. The following rates have been obtained for members and any who may attend the meeting:

European Plan.—$2.50 per day and up; two, in one room, $1.50 per day each, and up; room with bath, one person, $3.50 per day; two persons, $5.

American Plan.—$4 to $5 per day.

The Executive Committee has arranged for the presentation of the following papers:

"Candle Power: Its Present Relation to the Gas Industry;" by Mr. Jno. R. Lynn, Portsmouth, Ohio.

"The Operation of a Central Station Electrical Plant with a Gas Engine;" by Mr. J. C. Small, Aurora, Ind.

"Public Control of Rates;" by Mr. Geo. McLean, Dubuque, Iowa.

"The Systematic Location of Gas Mains as Opposed to a Conduit;" by Mr. Donald McDonald, Louisville, Ky.

"Temperatures in Condensation;" by Mr. W. H. Barthold, Grand Rapids, Mich.

"Regenerative Benches;" by Mr. Howard C. Slater, Milwaukee, Wis.

"Monthly Technical Report of Operations in Coal Gas Works;" by Mr. W. E. Steinwedell, Belleville, Ills.

"The Hygienic Effect of the Use of Gas;" by Mr. Thos. D. Miller, Dallas, Texas.

"Wrinkle Department;" Edited by Mr. Fred. H. Shelton, Philadelphia, Pa.

Reports will be received from the Committee on Cyanides and from the Committee on Isolated Generators for Bench Firing. Mr. Somerville will present a "Short Topic" relating to an experience in telescoping a gas holder.

The Western Passenger Association, from points in Eastern and trans-Missouri territories, Central Passenger Association, Trunk Line Association, Southeastern Passenger Association, Wisconsin Central Lines, Chicago, Rock Island and Pacific Railway Company and the Chicago and Alton Road, have granted rates of one and one-third fare for the round trip, conditioned on 100 certificates being presented to the Secretary for indorsement. The territory embraced by the above Associations includes all State divisions east of the Mississippi river, except New England. The following States and Territories west of the Mississippi river are in the territory covered by the Railway Associations granting reductions: North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, Missouri, Nebraska, Kansas, Oklahoma, Indian Territory, Colorado and Utah.

All persons attending the meeting will purchase a first-class ticket at starting point, paying full fare for same, obtaining from agent a certificate stating that the person whose signature appears on same has purchased, at full tariff fare, one first-class ticket to Chicago, which certificate, after it has been signed by the Secretary of the Association and a representative of the above Passenger Associations, will entitle the purchaser to a one-third rate returning home.

Apply to ticket agent at least 30 minutes before departure of train. All station agents do not have a supply of certificates, but they can be obtained by request, if notification is made in time. Persons outside the territory embraced by the Passenger Associations mentioned above should purchase a ticket to nearest point within one of said Association, and from there purchase a ticket to Chicago, obtaining a certificate which will, if properly endorsed in Chicago, entitle them to a one-third fare returning to place from which certificate was obtained, provided it is endorsed by a representative of the Passenger Associations, who will be present at the meeting, and the undersigned.

Those who live in Western Passenger Association territory should consult local agents several days in advance of purchasing ticket to Chicago, in order to reach an understanding with the different roads as to the junction point via which they will make rates applicable. Some local agents sell to junction points, where delegates can re-buy to destination. Certificates held by wives of the delegates attending the meeting will be honored in the same manner as those held by the delegates themselves.

A beefsteak dinner, to be provided by the Association, will be held Thursday evening, at the Chicago Athletic Club, tickets for which will be sold at $5 each. While the ladies will not participate in the dinner, arrangement will be made for their entertainment.

As it is necessary that arrangements for this dinner should be perfected at an early date, it is requested that all those who expect to attend the meeting will notify Mr. H. D. Harper, Chicago, Ills., of the Committee, as early as possible of the number of tickets they will require.

All queries sent to the Secretary for the Question Box will be assigned, in advance of the meeting, to members for answer.

The Secretary will be pleased to answer any communication pertaining to the meeting, and will mail blank applications to any who desire to become members of the Association. JAMES W. DUNBAR, Secy.

BRIEFLY TOLD.

THE NEW YORK CITY GAS SITUATION.—The latest indication respecting the gas supply situation of New York city proper had its source in the annual meeting of the Standard Gas Light Company, whose shareholders met last Wednesday to name the officers that should control its doings for the ensuing year. The meeting was in every sense harmonious. The retiring Board of Directors was unchanged, save for the naming of Mr. John U. Brookman, to succeed Mr. Russell Sage, who was deposed from the Presidency of the Company some months ago. The other officers chosen were: President, Mr. Frank Tilford; Vice-Presidents, Messrs. Oliver S. Carter and E. A. McAlpin; Treasurer and Secretary, Mr. W. G. Hoyt. Mr. Tilford had been acting as President of the Company, since the involuntary "resignation" of Mr. Sage from that post some time ago. The reports submitted went to show that the Company had largely increased its business, and that it was prepared to expend quite a sum of money to still further increase its trading in the city district north of the Harlem river. The tenor of the annual statements also supported the contention that there was money in gas at 65 cents per 1,000 cubic feet. It could of course be said that there would have been more money in gas at the legal rate of $1.05 per 1,000; but the shareholders were granted the privilege of thinking that out for themselves. A review of the proceedings at the Standard's meeting, so far as that review may be made by one who did not share in its deliberations, would seem to indicate that the controllers of the Company are in at least fair sympathy with the aims of those who control the fortunes and property of the Consolidated Gas Company. If such is the case, and we believe that so it is, the legitimate successors to the property of the New York and East River and Equitable Gas Light Companies will shortly have a hard time in making or causing both ends to meet. For if the Standard Company confesses little profit at 65 cents per 1,000, which President Tilford and his associates admitted at their last annual meeting, providing of course that they told the truth, where is the New Amsterdam Company to come in? Bonds are the securities that must prevail under modern financial laws. Of these the Consolidated Company has virtually none; the Standard has few, and the New Amsterdam has many. The situation in the gas supply of New York city is reaching the critical stage, and the signs of the times go to show that regularity and honor, as shown in the course pursued by those who direct the affairs and who control the fortunes of the Consolidated Company, are about to prevail.

NOTES.—Our current advertising columns show that Mr. John Dell, of St. Louis, Mo., is now connected with the Missouri Firebrick Company, of that city, as its General Manager. That good luck will be his in the venture must be the wish of everyone who knows him.——Mr. James H. Wheeler, of the Peoples Gas Light and Coke Company, of Chicago, died in Chicago, the morning of the 3d inst. He had been connected with the gas interests of Chicago since 1884. He was in his 55th year.——Mr. Thomas Dolan, President of the United Gas Improvement Company, of Philadelphia, is reported, in the Philadelphia *Ledger*, of the 10th inst., as having said this: "Referring to the rumors that the United Gas Improvement Company or myself have acquired or are negotiating for the acquisition of the New Amsterdam Gas Company, either alone or in connection with other persons—rumors which have appeared in the public prints a number of times recently—I desire to say that they are absolutely without foundation. Our relations with the Consolidated Gas Company, of New York, are of the most cordial character, and we have not considered, and will not consider, any proposition nor enter into any negotiation which will disturb these relations."——Mr. W. H. Pearson, Jr., of Toronto, Canada, sailed for Europe last week.——At the annual meeting of the Altoona (Pa.) Gas Company, Mr. John Lloyd was re-elected President.——Brief word comes to us that Mr. T. E. Connelly, who will be remembered as one of the founders of the Connelly Iron Sponge and Governor Company, died at Colorado Springs, Col., the morning of Thursday, the 3d inst. Later on appropriate record will be made of his connection with the gas industry, which dates back many years.——The proprietors of the East Albany (N. Y.) Gas and Light Company propose this season to supply Bath on-Hudson with gas.——The proprietors of the Oswego (N. Y.) Gas Light Company and those of the Home Electric Light Company, of Oswego, are to be vested in a corporation, to be known as the Peoples Gas and Electric Company, of Oswego.——It looks that the manufacturers of wrought iron pipe have accepted the inevitable. Having sold pipe while prices were high, it seems they are about to sell pipe now at prices not quite so high. And as it is with wrought so it seems to be with cast. Pipe prices are likely to be very much lower in August than they are now.

Incandescent Street Lighting.

[A paper read at the last meeting (Cambridge, England) of the Eastern Counties Gas Manager's Association, by Mr. J. H. SHELDRAKE.]

The subject of this paper should, at the present time, be of some interest to gas engineers and others concerned in the lighting of our public thoroughfares; and my object in placing the matter before you is to give a few practical hints, which may be of use to those who have not had much experience in this form of lighting. Many failures have been recorded, arising from insufficient knowledge of technical details by those who have had a new form of lighting placed in their hands In a great number of towns, I am happy to say, these difficulties have been overcome, through the energy and skill shown by those who had the subject under their superintendence.

To show the enormous strides which have been made during the past twelve months in incandescent gas street lighting, I am in a position to state that upwards of 67,800 lamps have been altered from flat flames to incandescents; and I venture to say that, in the coming year, these figures will be far exceeded.

Lighting authorities in this country, who have been willing in the past to allow 5 cubic feet per burner for street lamps, now show a disposition to take advantage of incandescent lighting, by using burners of a small size, instead of giving the public the benefit of the extra light which could be obtained. I think this system is one which all gas managers should fight against; and no burners consuming less than 3 cubic feet of gas should be recommended.

As to the distance at which lamps are fixed, there is no settled measurement; each town or district adopts its own distance, to suit the requirements or the pockets of the ratepayers. In some suburban parts of our cities and towns, however, there is no doubt that the lamps are fixed too far apart; whereas, in main roads, where they have the assistance of shop lighting, they are put much closer.

With regard to the lamp posts themselves, in all new installations it is very important to have lamp posts of strong pattern, and well fixed into the ground, at a distance from the curb, so that no vehicles passing would be liable to touch them. In the past, lamp posts were fixed close to the edge of the curb; and, from my experience, when these lamps have been fitted with incandescent burners, the breakage of mantles has been very great. But this is a matter which is being rapidly altered, and is not likely to be a trouble in the future. There is one thing, however, to which I earnestly call the attention of gas engineers, and that is the design of the pillars they order. Why do they stick to the old octagon, fluted, and other similar patterns, when, for a few shillings more, nice designs and good castings can be obtained? At the present moment, I think I am right in stating, there are more old-pattern lamp posts sold than any other. This is a subject which, I think, ought to be seriously considered when new roads and districts are being lighted.

Here, in England, the policy has been to buy a lamp post, lantern, cradle, lever tap, and governor all for about $10.50. Surely, those days ought to be now past. On the Continent, you will find, they spend from $40 to $60 on every lamp that is fitted. Independently of this, they are always kept clean (I refer to the lamp pillar as well as the lantern); and anyone who has visited Paris or Berlin, and such cities, must have been struck with the fine appearance of their street lighting.

Lanterns.—The great point in a street lantern for incandescent lighting is the ventilation. It is no good whatever attempting to fix incandescent burners in ordinary street lanterns, where the top of the lantern is open, or there is a pane of glass out at the bottom, which has, in the past, been used for the torch. The bottom of the lanterns should be closed as much as possible—in fact, if it can be closed altogether, it will be all the better. The top of the lantern should have an inner chimney with a cone at the bottom over the burner. By this means, the hot air from the burner escapes up the inner chimney and out at the top; and any down draught which might find its way into the lantern from the top, is diverged by the cone, and does not affect the mantle. All existing street lamps (where it is not desired to have new ones) can easily be altered in this manner, though I think it very important that we should get away from the old 14 inch street lantern, which has been in existence from the earliest days of gas lighting. They should not be less than 16 inches square, as, in such lanterns, there is a larger capacity, and the mantles are not likely to be affected by the draught, as they would be in a smaller one. Besides, a lamp of this description is more imposing in appearance.

Burners and Anti Vibrating Arrangements.—I now come to an important part—viz, the burner. From past experience, it has been

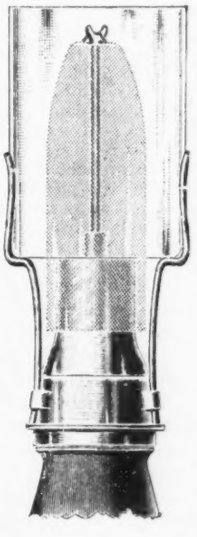
proved that some form of anti-vibrating arrangement must be used. There are instances where they are not employed; but I think you will find that, in these cases, the lamp posts have been of a very strong pattern, and not subject to much vibration from the traffic. I consider any form of anti-vibrator which has flexible indiarubber connections is not one which gas engineers should seriously adopt. The mere fact of a flexible connection to a street light does not give me the impression of its being a workmanlike job when fitted. Independently of this, there is the great risk of leakage—which would possibly destroy the lamp—caused either by carelessness or by the indiarubber perishing. This form of anti-vibrator has been extensively used; but I venture to think that an anti-vibrator which has nothing but metal parts is one which must commend itself for wear and tear.

A form of anti-vibrator, of which I have had considerable experience lately, is Chalmer's. This, when originally put on the market, had an asbestos washer in the head of the burner, to prevent the air from the outside of the Bunsen tube passing into the head of the burner, and thus spoiling the quality of the flame. Experience has proved, however, that this washer, by its continual action, is liable to wear away and let in an admixture of more air—reducing the calorific power, with the result that the mantles do not give anything like the illuminating power they should. This, I am happy to say, has now been overcome by the introduction of a metal ferrule and washer, which takes the place of the asbestos, with the result that a good flame can always be maintained; and I should strongly recommend gas engineers who have any of the original form of anti-vibrators under their charge, to have them altered. In fixing the burner in the lantern, great care should be taken that it is perfectly vertical, and that the spring works freely, so as to give the full amount of resiliency.

Governors.—The question of suitable governors for incandescent lighting is one which requires care in selecting. They should be constructed to give a pressure on the outlet of not less than 10-tenths. Many that have been tested only give 6-tenths to 7 tenths, which is not sufficient to secure the full efficiencey of the burners; and, therefore, disappointing results are given, which are no doubt blamed to the mantle.

Mantles.—I now approach another important part, and that is the mantle. For the present, I do not wish to mention any other than the Welsbach, because I do not know how far I should be looked upon as an infringer, if I ventured to mention any other form of mantle until it had a legal existence. I believe, however, that the Law Courts, within a very short time, will settle this matter. But quite apart from any legal decision, improvements in Welsbach mantles are about to be made by the Welsbach Company as the result of a number of important experiments.

My wish is to call attention to the fact that mantles which are now used for the various sizes of burners should be fitted the regulation distance from the top of the burner. We all know that the magnesia forks which are used vary in length; but, if care is taken to have these the right size, and firmly fitted into the top of the burner (I recommend always that a small piece of fine asbestos thread be just pressed in with the fork), the mantle will last much longer than if it is fitted on a loose, shifting fork, the effect of which is that, when the burner is alight, the mantle is always on the move, and, consequently, wearing away at the bottom. I strongly advise everyone to look to this; and I may say that I think, before long, forks of a different pattern will be adopted, the lower part of which will be in the form of a cone.



It is important that all incandescent burners should be, at every opportunity, cleaned out, so that no thick deposit of dust is allowed to accumulate in the interior. This is always apparent by the flame of the burner rising above the mantle; also by the blackening of the top of the mantle, and consequent loss of illuminating power.

Glass Protector.—Never attempt to use mantles without a glass protector. This has been recommended in the past; but I strongly advise everyone to see that some protection is given, not only to protect the mantle from draughts, but also during the process of cleaning the inside of the lantern. I have recently been experimenting, with the idea of finding out the best glass that can be used; and I am pleased to say that I have found a form of glass which will not only prolong the life of the mantle, but also give a considerable increase in illuminating power.

The burner used was a No. 4; and I find the following were the results:

	Pressure.	Percentage Increase in Light over Unprotected Mantle.
Mantle protected with the ordinary bulb globe..... ..	1.0	2¼
	1.5	4
	2.0	4
Mantle protected with new form of glass..	1.0	18
	1.5	20
	2.0	18½

Lighting.—With regard to the means of lighting, personally I prefer the bye-pass with the automatic cock, which, when the burner is alight, turns out the bye-pass. Unfortunately this form of tap is often abused by having the flame too long, or not under control with regard to the pressure. Two screws, however, have been introduced in the bye-pass, so as to check or minimize the excess pressure; but, anyhow, these bye-pass jets should not consume more than 0.3 cubic foot per hour. Working this out, with gas at 75 cents per 1,000 cubic feet, and allowing for an average of 3,000 lighting hours—which, of course, varies according to the different localities—would mean a consumption for the year of 1,728 cubic feet, costing $1.31 for each bye-pass.

There have recently, however, been introduced several systems, one of which is the patent arrangement of Messrs. Simmance and Abady, whereby a tap is so constructed that, by giving it one movement, the torch is passed through the flap at the bottom of the lamp, and lights the bye-pass jet. The torch is then withdrawn, and the tap is given another turn, which lights the burner and extinguishes the bye pass. This works very well, and, no doubt, will find favor with many.

There is also a torch, working upon a hinge, which can be inserted into the lantern and thrown at an angle over the top of the burner. This is a form which, I believe, has now been perfected and brought out by Mr. G. F. L. Foulger, of the Gas Light and Coke Company; and, no doubt, many of you have had particulars of it.

Of course, with the torch form of lighting, it is necessary to have a flap at the bottom of the lamp, hinged from the center. But there is, I think, considerable risk of danger to glasses and mantles, unless great care is used by the lamplighter when inserting the torch.

Cost of Mantles.—The cost of mantles has been, in some districts, a very important item. Not only were the lamp posts close to the curb, but the stand pipe was not central, and was quite loose in the column; and the consequence was that the least vibration in the road affected the mantle in a very serious manner. In other districts, I hear of only about 1½ mantles being employed per annum per burner. This is a very low average and shows great care in their use. I think, however, that, with all the latest improvements in the anti-vibrator, and the proper fitting of the mantles to the burners, an average of 4 mantles per annum (with the new form of glass) would not be excessive, considering the high results which are obtained. In every case it should be insisted upon that an anti-vibrating arrangement should be used.

Lighting Efficiency of Different Burners.—I have recently been assisting at some tests to determine the lighting efficiency or diffused light given by different burners at various distances. The first which was tested was one of the "Westminster" lamps, which had a Kern burner, No. 4 size, fixed at a height of 10 feet from the ground. Several readings were taken at 3, 6 and 9 meters distance from the light at a height of 5 feet from the ground. The photometer used was of German manufacture, and is known as Professor Weber's. At a distance of 3 meters, the light given was 11.35 meter candles; at 6 meters, 3.37 meter candles; and at 9 meters, 1.65 meter candles. These figures (see Diagram A), therefore, state the actual useful light furnished by a burner which was giving about 106-candle power. In a burner of this class, of course, the light given in every direction would be the same.

I afterwards substituted for the Kern burner a 5 feet Bray's burner, which consumed 5.1 cubic feet of gas per hour; and I found the light given from this, at 3 meters distance, to be 1.048 meter candles, at 6 meters 0 278 meter candle, and at 9 meters 0.123 meter candle. (See Diagram B.)

To follow up these experiments, it occurred to me that it would be very interesting indeed to know how Mr. Smithard, of King's Lynn, fares with his electric light; and I, therefore, sent down to test under the same conditions as those under which the previous experiments had been carried out. I found that there were two nominal 16-candle power incandescent lamps in each lantern; and, upon testing their photometrical power, they were found to give 24 actual candles. Upon testing these at 3 meters distance, an effective candle power was given of

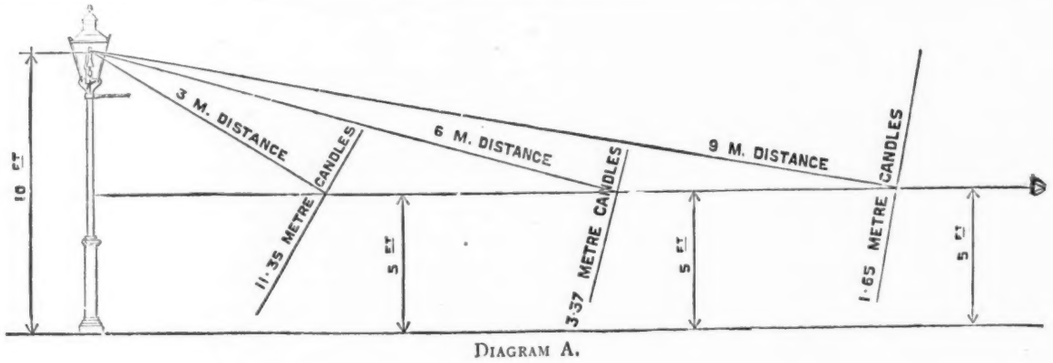


DIAGRAM A.

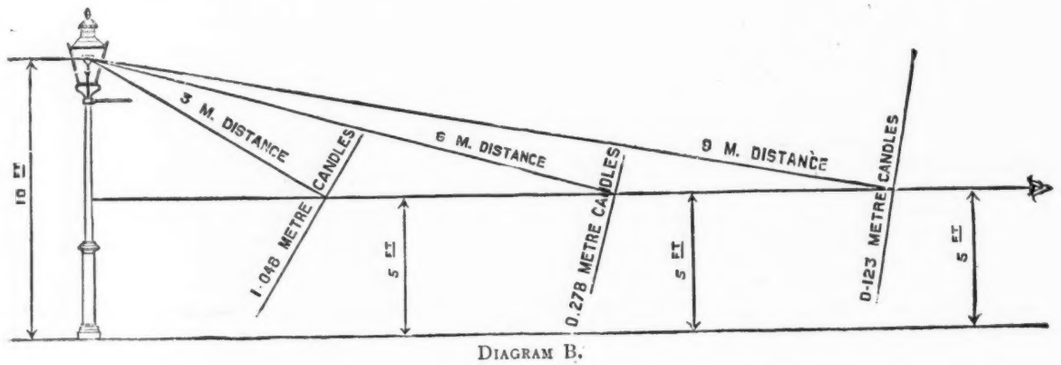


DIAGRAM B.

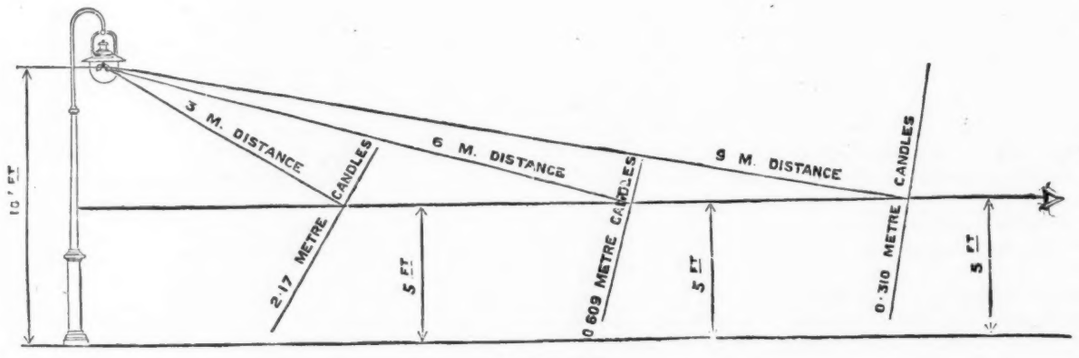


DIAGRAM C.

2.17 meter candles, at 6 meters distance 0.609 meter candle, and at 9 meters distance 0.310 meter candle. (See Diagram C.)

To prevent any misunderstanding with regard to the figures which I have given, I think it right to mention that the candle power shown at the various distances represents the light of a corresponding number of candles, if placed 1 meter from a screen fixed at the distances mentioned.

With these figures before us, it is now possible to form some reliable opinion as to the actual cost of street lighting by the three systems tested. Presuming gas to be 75 cents per 1,000 cubic feet, which will do for illustration, the cost of the No. 4 Kern burner will work out at $3.22 per 1,000 hours. In this calculation I have allowed for the bye-pass. With a 5 feet flat flame burner, the cost for a similar period would be $3.75; and with electricity at 6 cents per unit, the cost would be $7.50. At King's Lynn the cost is 11 cents per unit. I have taken the price for electricity at 6 cents, which is, I consider, the lowest figure at which it can possibly be supplied at a profit.

To sum up the above results, the difference will be more apparent if I mention that to obtain 106 candles by the use of a Kern burner, it costs $3 22 per 1,000 hours; with a flat flame burner, giving a light of about 10 candles, the cost would be $3.75; or with electricity, giving a light of 24 candles, the cost would be $7 50 for the same period. These figures will, I think, prove that gas engineers, by adopting the incandescent gas system of street lighting, are going in the right direction.

In conclusion, the position between gas companies and municipal authorities is not always of the happiest; but, with regard to street lighting, I think that, in view of the competition which may or does occur, gas companies should endeavor, by all means, to meet them in as liberal a spirit as possible. The effect of this is seen in the spirited policy of the South Metropolitan Gas Company.

Discussion.

Mr. W. J. Best (St. Ives) remarked that Mr. Sheldrake had certainly preached from his own point of view; but, in his (the speaker's) experience, there were many places where the incandescent mantle would not answer. In hotels, for instance, where carpets were frequently being taken up and swept, dust got into the mantles and burners, and there they were more or less a failure. He was not for a moment depreciating incandescent gas lighting, because he thought it the light of the future.

Mr. W. D. Child (Romford) remarked that there was no doubt the incandescent gas light had enabled gas companies to hold their own to a very great extent against the competition of other lights; and this they would have had considerable difficulty in accomplishing in any other way. Therefore, they were glad to receive from Mr. Sheldrake any suggestion that would assist them to utilize this splendid light to the best advantage. He agreed with him that gas companies should not avail themselves of the smaller quantity of gas required to give a high illuminating power, by cutting down the consumption. They had far better avail themselves of the greater intensity and effect in lighting that might be obtained by using (say) 4 cubic feet of gas per hour instead of the ordinary 5 cubic feet, and so show what really good and

effective street lighting could be secured by simply changing from flat flame to incandescent burners. Mr. Sheldrake went on to speak of lamp columns. Those managers who had not rapidly advancing towns could not think of changing from the old-fashioned column at the same time that they adopted the incandescent burner; but in districts that were growing, of course they could gradually introduce well-designed styles of lamp columns, and put the old-fashioned ones into places where they would not be so noticeable. He did not think that anyone but a handy man or amateur would fall back upon an indiarubber connection. An engineer would quickly endeavor to devise some kind of connection which would be suitable for an anti-vibrator burner. When he first tried the incandescent light, he used an indiarubber connection; and he soon found that where he saved two mantles, he destroyed two burners and lanterns. As to the length of the forks for supporting the mantles, he believed Mr. Sheldrake said they varied; but when the Welsbach Company supplied new burners, they certainly ought to provide the best appliances for using them. He had himself, in making experiments with the incandescent burner, been tempted to break a piece off another fork and put it into the socket made for it, so as to utilize the mantle to the fullest extent; and he had an idea that he obtained a better illuminating power than was given by a mantle on the length of fork usually sent out by the Company. He thought it was the Company's duty to determine what length of mantle would give the best illuminating power with the quantity of gas they recommended should be consumed, and to supply the right length of fork, rather than leave the gas manager to use indiscriminate lengths.

Mr. J. T. Jolliffe (Ipswich) said his experience led him very much to re-echo every word that Mr. Sheldrake had said, except perhaps that he (Mr. Jolliffe) was not a great believer in the Kern burner. He had not yet been able to get any really satisfactory results that would justify him in discarding the "C" burner for the Kern. But he did think that anyone who was going into this question might with advantage abandon the bulb glass and use the perforated chimney that had been brought out by Messrs. Falk, Stadelmann & Co. With this alteration, he found a very considerable gain not only in lighting effect, but also in the duration of the mantles. In his paper, the author stated that somebody was trying to get down to 1½ mantles per lamp per annum. He (Mr. Jolliffe) should say, "Don't." Their object was to light the streets properly, and by cutting down the mantles to so low a figure as that, they would not get the best possible results. All the members present knew as well as he himself did, that the lighting effect of the Welsbach, or any other mantle, seriously diminished after any lengthened period of lighting. Therefore, he said, "Use your mantles liberally." He did not think that less than 6 per annum should be attempted. He knew that this was a costly matter; and it would be a very important thing for gas companies if the Welsbach Company would reduce the cost of their mantles. It seemed to him an astonishing thing that in Berlin one could buy mantles for 5 cents apiece; while the retail price in England was 25 cents each. There did not seem to be anything at all to account for such a mighty discrepancy. He daresay many of the members had (he had himself over and over again) been offered mantles from Berlin at a fraction over 5 cents each. He had tried these mantles, and while he would not say they were quite as good as the Welsbach, they were nearly so. If the Welsbach Company, instead of spending so much money on law, would supply cheaper mantles, it would be an advantage to gas companies and to themselves.

Mr. R. Brown (Cambridge) said the paper was one with which they could nearly all agree. Regarding corporations cutting down the gas consumption to the lowest possible figure, that had been their experience in Cambridge. He tried to introduce the No. 4 burner, so as to obtain the best possible light; but the Corporation insisted on having the No. 3, in order to lessen the consumption of gas. In his opinion, no burner should be allowed in any public street of a size smaller than the No. 4 Kern. Mr. Jolliffe had spoken of the Kern as not being so good as the "C" burner. His (Mr. Brown's) experience was directly opposite. After having had experience with Nos. 3 and 4 Kerns, he would never advise anybody to go in for the "C" burner; the results obtained were very much greater. Mr. Sheldrake had taken them to task a good deal on the subject of lamp columns. Of course, the columns had not made the same progress as the other fittings; and this was not the first time they had been held up to ridicule. He believed it was Mr. Marshall who, at a meeting of the Institution of Gas Engineers, referred to the London gas lamp posts as monstrosities. Mr. Sheldrake himself said they had been buying all they required for $10.50 each; and he then advised them to spend $40 to $60. This would mean extra capital and interest, which would add to the cost per lamp per annum; and he did not think the corporation was yet born who would be prepared to pay extra for any improvement they made in the lamp columns. He agreed that to use ordinary street lanterns for incandescent lighting was simply to quote disaster; but whether they could be easily altered for the purpose depended on the character of the lamp. In his case, the lanterns were very old. It would be difficult to alter them; and they would not be a success. If a lantern required a new bottom and top, he thought it better to purchase a new one. He admitted that a No. 4 Kern burner required a 16 inch lantern; but 14-inch lanterns would do equally well for No. 3 burners. As to governors, he was much in doubt as to whether they secured the advantages claimed for them. Concerning the number of mantles used, he did not intend to try to get down to 1½ per lamp per annum, as what they wanted to do was to give the public as good a light as possible. In his case, the average had worked out to 9 per annum; but this was with incandescent lighting only in the main streets. Now that they were lighting the bye-streets, the mantle account would be much less. He thought the glass protector was a great improvement on the ordinary bulb, and he should probably recommend his Board to adopt it. The question of the bye-pass was one that had exercised the minds of both himself and his Board, as to whether they should do away with it altogether. The author had mentioned the torch arrangement of Messrs. Simmance & Abady; but he did not appear very enthusiastic about it. It seemed to him (Mr. Brown) that there would be very great risk in using a torch inside a lantern containing incandescent mantles, as they could not make lamplighters do the same as they would do themselves. He thought that if the bye-passes were improved, so as to give not more than ⅛-inch jet, it would be a great benefit.

Mr. E. W. Smith (Chelmsford), while complimenting Mr. Sheldrake on the excellence of the paper, said there were one or two points he could not quite agree with. Speaking of the distance at which lamp columns were fixed, the author pointed out that in main roads, "where they have the assistance of shop lighting, they are put much closer" than in other parts. Did he understand the author to mean that they were too close, because, if so, he would point out that they must have regard to the times the shops closed. Unless the lamps were kept a reasonable distance apart, he was afraid that, on Sunday evenings and after the shops were shut, they would find there was not sufficient light. He agreed with previous speakers that gas companies could not discard their old-fashioned lamps. The lanterns were a considerable item, and they must continue to use them, or adapt them to the newer form of lighting. As to the new glass protector, in the old days of incandescent lighting they were told they must use chimneys 9 inches long to get the best results. His experience had tended in the other direction; the shorter and wider the chimney (to a point), the better the light obtained. He was inclined to think the alteration proposed by Mr. Sheldrake was a very good one. At Chelmsford, the lighting in the town itself had been for many years done by electricity; and he had been informed recently that the charge per lamp per annum for incandescent electric lighting was $11.56—that was used throughout the year. He mentioned this because he did not see that the author had told them the consumption of the No. 4 Kern burner; and it was well to remember these things in comparing the cost. He considered the Kern better than the old "C" burner.

Mr. R. G Shadbolt (Grantham), referring to comparisons of the old "C" bulb burner and the Kern for use in street lamps, said there was one point they had overlooked, and that was the old-fashioned reflector in use with the bulb burner. For some four winters now they had lighted the central part of Grantham with incandescent burners. In the first instance, they experimented with the ordinary "C" burner with talc or mica chimneys; but they very soon adopted the bulb burner. He found, comparing their own lamps with those of the Railway Company (which were in close proximity to the "C" bulb lamps, and were fitted with two No. 4 Kern burners), that, although the light was very intense or brilliant at the center of illumination, still the effect upon the ground did not seem to be as good. In fact, they were satisfied at Grantham that the "C" bulb burner was preferable to the Kern burner. Having related a little experience in which there was an excessive destruction of mantles outside a toy shop owing to the packing of empty crates round the column, he said he agreed with Mr. Jolliffe that efficient lighting could not be accomplished with less than 6 mantles per lamp per annum. In his own case, they used an average of 5 or 5½.

Mr. J. Carter (Lincoln) could not quite see why the old rub against lamp columns had been indulged in, nor did he see any reason why they should be recommended to associate an expenditure of $40 or $60 for a lamp and column with the establishment of the system of incandescent street lighting. The more economical they could make the

original adoption of the system, the more likely were they to succeed. During the last few months he had been conducting an experiment with the Kern burner; and in some cases he purchased new lanterns for the purpose, and utilized the existing columns, because he recognized that the object he was seeking to attain was not to provide an attractive lamp pillar for those who walked along the street in the daytime, but to provide as effective a light as possible in the streets at night time. He was thinking more of the lighting than he was of gratifying any aesthetic or artistic taste. In two cases he bought new lanterns, and in about twenty cases he utilized the somewhat despised 14 inch lanterns, fitting them with opal tops and closing in the bottom part. The cost of this was about 62 cents to 75 cents. The lamps were supplied with No. 4 Kern burners, with anti-vibrators; and after 1,871 lighting hours (with 23 to 24 lamps in use) only 3 new mantles had been required, and in the other 21 cases the original mantles were still in use—in fact, they had been burning for something like 2,000 lighting hours. Having explained the causes to which he ascribed the failure of the three mantles, he said that, after 1,800 hours' burning, in one case he put on a new mantle for the purpose of observing whether the ordinary passer-by would be able to distinguish between the light given by those that had been burning 1,800 hours and the new one; and a very careful examination would have to be made before anyone would discern any appreciable loss of light. He would like to know whether Mr. Sheldrake could tell them what was the pressure at which the Kern burner could be relied upon to give the utmost efficiency.

Mr. J. H. Troughton (Newmarket) said, with reference to the new glass protector, Mr. Sheldrake in his paper compared the results secured when using this with those obtained by a naked burner. He thought it would have been much more satisfactory if he could have given them the same comparison with the glass that was sold as the latest improved bulb. In his table, Mr. Sheldrake showed that with this glass protector an increased lighting efficiency of something like 14 per cent. was obtained. Some eight months ago they adopted the incandescent system at Newmarket; and all the lamps were fitted up with Nos. 3 and 4 Kern burners. From experiments, he had found them a very great improvement over the "C" burner. In regard to gas consumption, the "C" burner used 4 cubic feet per hour; while the Kern burner consumed a little over that with the bye-pass. There was a good deal of waste with bye-passes if left to the lamplighters; and besides they blackened the mantles. He was rather sorry the author had not said anything about the matchless form of lighting lamps. If some such method could be invented for street lighting, it would be a great improvement. He also missed from the paper any reference to intensified gas lighting.

The President, having acknowledged the indebtedness of the Association to Mr. Sheldrake for his paper, said that some twelve months ago his Company offered to light Sleaford with incandescent burners, if the authority would assure them of a 3 or 4 years' contract. They did not want any guarantee. The authority could not see their way clear to give any assurance owing to an application by them to the Board of Trade for a Provisional Order to supply electricity. Notwithstanding, he advised his Board to light up the principal streets with the incandescent burner. They adopted his suggestion; and now they had the whole of the main streets lighted with Kern burners fitted in new lanterns. Although they used an anti vibrator burner, and had protected the mantles in several ways, the average use of mantles was a little over 6 per annum.

Mr. Sheldrake, in replying, said that, with reference to Mr. Best's remarks, the paper dealt with street and not interior lighting. There was no doubt that the Welsbach or any other form of incandescent burner must be properly and constantly cleansed from all dust and dirt, which, of course, militated against its lighting power. As to Mr. Child's criticisms, the forks to which he (Mr. Sheldrake) referred in the paper were those sold outside the Welsbach Company. There were thousands of these bought from makers who did not take the trouble that the Welsbach Company did to see that they were sent out of the correct length. Mr. Jolliffe had alluded to the use of the bulb chimney with the "C" burner. There was no doubt that this form of chimney did protect the mantle; but he (Mr. Sheldrake) considered there was a great risk in using an enclosed chimney of this form, and a great loss of illuminating power unless they were kept very clean. They "bloomed" very quickly; and the consequence was there was a great loss of illuminating power. Comparisons had been made between the "C" and the Kern burner. The former collected the dust much quicker than the latter; and, in his opinion, one of the great advantages of the Kern burner was that there was no part on which the dust could accumulate, excepting in the cone, which took a long time to choke. A short time ago he saw some tests made with a dirty "C" burner, which only gave about 13 candles; but by cleaning it a light of 42 candles was obtained. This proved that the cleansing of the burner was an important point. As to the cost of mantles in Berlin, of course that was a subject on which he could not say much. In Berlin, there were no patent rights; and there were in England. Mr. Brown had taken him severely to task in one respect, in saying that he (Mr. Sheldrake) had ridiculed the old lamp posts. This was not so. The position he took up was that those who were putting down new lamp posts should get the ironfounders to give them a better design than the old octagon and fluted patterns. He did not think for a moment that in England they would spend the same amount of money on the street lamps that was done on the Continent; and he did not see that they could. They might, however, when opportunity arose, have something a little more tasteful. He agreed that if the ventilation of a 14-inch lantern was altered, it would do for a No. 2 Kern burner, but he should not recommend it for a No. 4. He did not think it was fair to the burner; and the top of the lamp was so open that any down draught would be sure to affect the mantle in the long run. With regard to the average of 1½ mantles per lamp, that was a figure published in connection with one of the West of England towns. Personally he doubted it. An average of 6 a year was a very good result; but with the new protector, it might be brought down to about 4. He did not think a ½ inch flame for the bye-pass would be sufficient, as the least draught in winter would blow it out; and he thought they ought to have a ⅝ inch flame. As to the distance apart of lamp posts, they should be nearer in towns and cities than in outlying districts; but when they came to hear of lamps being 150 and 200 yards apart, it was certainly a distance that ought to be reduced. In some main thoroughfares, the lamps were only 25 yards apart; and his point was as to whether in such cases they might not be a little farther apart, and the outlying districts get the advantage. For the "C" burners, he thought a 9-inch chimney was longer than there was any necessity for; and a large number had been used only 6 inches long. The new glass was not a chimney; it was only a protector for the mantles on the new burners. The "C" bulb burner was no doubt the best of its class; but such good results could not be obtained with it as with the Kern burner. He congratulated Mr. Carter on the splendid results he had obtained; and, speaking of governors, he thought that the highest results were realized when the gas was at 1 inch pressure. He did not think Mr. Troughton had correctly read his figures as to the percentage increase in light of protected over unprotected mantles. They showed that with a bulb glass an increase of 2½ per cent. was obtained over the naked mantle, and with the new form of glass 18 per cent. As to matchless gas lighting, they had a new method which was a great success. By turning a tap to the right, a bye-pass was lit; then by putting the lever or tap vertical, the burner was full on; and by turning it to the left, the flame could be extinguished or lowered. This device had been perfected for interior lighting; and before long he had no doubt they would have it adapted for street lighting. He could not say he was altogether in favor of intensified lighting. Splendid results were obtained—30 to 40 candles per cubic foot of gas—but with an expenditure not only of the gas, but of some form of energy, besides which there was the increased wear and tear of the mantles. In some experiments with a series of Kern burners, he had obtained about 104 candles per burner, and 240 candles when working at a pressure of about 8½ inches; but instead of only using 4 cubic feet of gas, he burnt 8½ feet, and energy had to be provided to furnish the increased pressure. Two No. 4 Kern burners would give equal satisfaction, without any trouble or any outside energy. Of course, in certain places a very brilliant light would be useful, no matter what the cost; but for street lighting, he did not look upon intensified lighting as having any chance for some time to come.

Fouling of Gas in Holders.

The *Gas World* says that Dr. Smits, of the Amsterdam gas works, explains the occasional perplexing and annoying appearance of sulphuretted hydrogen in gas after it has passed through the purifiers in the following manner. Assume that the gas contains some ammonia and some bisulphide of carbon. Then in the water of the gasholder these will react upon one another, forming an ammonium dithiocarbonate. If the action be confined to these two materials with water, as in a laboratory experiment, the liquid kept in the dark for 24 hours becomes a red solution of dithiocarbonate, $CS_2 + 2NH_3 = CS(NH_2)(SNH_4)$; and this solution gives a red precipitate with acetate of lead. But if carbonic acid, or coal gas containing carbonic acid, be led through this solution, or if the solution be acidified, then there is sulphuretted hydrogen present, $CS(NH_2)(SNH_4) = H_2S + NH_4CNS$, sulphocyanide of ammonium.

Thus the sulphuretted hydrogen formed is equivalent to the ammonia present in the gas and entering into the reaction.

This bisulphide of carbon is mainly formed during the later stages of the distillation of the coal ; and it is produced by the mutual action, at high temperatures, of carbon and iron pyrites. The quantity is too small and the volatility of the bisulphide too great to allow much of it to be separated on condensation ; but a little of it is mechanically separated along with tar vapors. Some of it is removed in the scrubbers in two ways : (1) by its action on ammonium sulphide $(NH_4)_2S + CS_2 = NH_4CNS + 2H_2S$; and (2) by its action on ammonia, forming dithiocarbonate as above. In the purifiers, where lime is used, there is considerable absorption of the bisulphide, $Ca(OH)_2 + H_2S = Ca(OH)(SH) + H_2O$; and then $2Ca(OH)SH + CS_2 = CS(SCaOH)_2$, basic calcium thiocarbonate. But if there has been much conversion of calcium hydroxide into calcium hydrosulphide, there is very little carbon bisulphide taken up, and if the conversion is complete there is none taken up. Where iron oxide alone is used there is nothing to absorb carbonic acid and bisulphide of carbon. The carbonic acid may be, say, 1.4 to 1.8 per cent., which is not important ; but the same cannot be said of the bisulphide of carbon, which may amount to 109 grains per 100 cubic feet, or even more. The absorption of bisulphide from gas is thus a matter of importance ; and if the carbonic acid can also be got rid of, all the better. Some think that where the hydrocyanic acid is absorbed in the wet way, by passing the gas through a solution of potassium carbonate in which ferrous carbonate is suspended, the bisulphide of carbon will also be caught. They work it out in this way : The sulphuretted hydrogen in the gas forms KHS in the potash solution, liberating carbonic acid, and this KHS unites with the carbon bisulphide, forming potassium sulphocarbonate, $2KHS + CS_2 = K_2CS_3 + H_2S$. But both the production of KHS and that of K_2CS_3 are reversible reactions, and the result depends on which compounds are present in excess. A great excess of H_2S, for example, will reverse the action given in the last equation, and with sulphocarbonate of potassium will produce KHS and CS_2; and therefore in the presence of an excess of sulphuretted hydrogen the absorption of carbon bisulphide will be very small. Further, carbonic acid acts in a similar manner upon sulphocarbonate of potassium, and similarly prevents the absorption of bisulphide of carbon.

Experiment confirms these conclusions. On leading pure gas first through a solution of acetate of lead, so as to remove any sulphuretted hydrogen, then through a solution of KOH, then through acetate of lead again, it was found that a part of the bisulphide of carbon was absorbed by the potash, with evolution of sulphuretted hydrogen, $4KOH + CS_2 = K_2CS_3 + K_2CO_3 + H_2S + H_2O$. The H_2S evolved in this reaction was absorbed by the excess of KOS, so that there were present in the second washing flask the three compounds K_2CS_3, K_2CO_3, KHS. Now, on passing through the series of flasks gas containing carbonic acid there was an evolution of sulphuretted hydrogen, darkening the liquid in the third flask, and that for two reasons :—(1) $K_2CS_3 + H_2O + CO_2 = K_2CO_3 + H_2CS_3 = K_2CO_3 + CS_2 + H_2S$; and (2) $2KSH + CO_2 = K_2CS_3 + H_2S$. Potassium sulphocarbonate is a yellow colored salt, hygroscopic, with a pepper smell ; it is soluble in water, and can be made by mixing K_2S and CS_2 in alcoholic solution. The corresponding acid, H_2CS_3, sulphocarbonic acid, is a dark oily liquid, which can be produced from K_2CS_3 by the action of weak acids, but promptly decomposes into CS_2 and H_2S.

As to the quantitative determination of the amount of bisulphide of carbon present in coal gas, A. Vogel showed, in 1853, that the bisulphide, acting upon an alcoholic solution of caustic potash, formed potassium xanthogenate, $CS_2 + C_2H_5OK = CS(SK)(OC_2H_5)$. This salt forms shining needles, soluble in water. This is the most practical basis for the quantitative determination of bisulphide in gas. The gas is dried by chloride of calcium, and is led for some hours through a solution of KOH in absolute alcohol ; the alcohol is then evaporated and acetic acid is added ; and then a few drops of a dilute solution of sulphate of copper bring down a yellow precipitate of xanthogenate of copper. Professor A. W. Hoffman proposed the reaction between CS_2 and triethylphosphine, $P(C_2H_5)_3$, which consists in the formation of a direct additive compound, $P(C_2H_5)_3CS_2$, which is insoluble in water ; but the triethylphosphine is rather too volatile, boiling at 117° C., and it is very inflammable, so that its use is not very convenient. The method of using it is the following :—Pass gas through three washing flasks in succession ; these flasks all contain a solution of caustic soda, on which floats a solution of triethylphosphine in ether. After a short time the liquid in the first flask begins to assume a red tint, and red crystals of $P(C_2H_5)_3CS_2$ begin to separate out. Keep on, measuring the gas used, until the liquid in third flask just begins to redden. Then mix the contents of the three flasks and recover the ether by distillation. Collect the crystals on a dried and weighed filter paper, wash well, and dry in a vacuum. Each gramme of $P(C_2H_5)_3CS_2$ corresponds to 0.3198 gramme CS_2. Both these methods are also perfectly applicable to the estimation of the amount of carbon bisulphide present in benzol and the like.

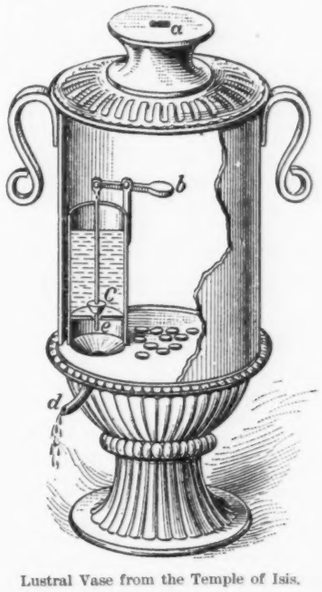
The Prepayment Gas Meter.

By Inspector, in *Metal Worker*.

The growing use of the prepayment gas meter—a differentiation of the nickel-in the slot machine—is a matter of no little interest for those for whom such subjects have interest at all. Before speaking of it, however, a brief account of the origin of this device—or, rather, of the principle embodied in it and all other slot machines—will be found to contain some facts worth remembering.

The slot machine is covered by any number of contemporaneous patents, but it is really one of the oldest mechanical devices of which we have any record. It was part of the paraphernalia of the priests of Isis in the Egyptian temples, and was a great source of revenue to those clever and unprincipled practitioners of leger demain. In his "Spiritalia," one of the oldest of books, Hero of Alexandria, who lived during the reigns of the second and third Ptolemies (B.C. 285–222), and was a great philosopher and mechanician, gives away a good many of the mysteries of the temples of Isis, and his account of the initiation of an acolyte into the service of that shrine is a text book for conjurers and modern practitioners of prestidigitation. Indeed, some of the very best tricks of the modern stage are fully described.

One of the clever devices noted by Hero is the lustral vase used in the temples of Isis to contain and dispense holy water. The worshiper who approached the shrine of Isis, for whatever ceremonies were being performed as devotions, was required to sprinkle himself with this holy water. Those who celebrated the Eleusinian mysteries were required to wash their hands with it. To make those using it buy it, and so exact tribute impartially, as well from those with a "pull" as from those without, the lustral vase was devised, and it was probably the first nickel-in-the-slot machine. What an Egyptian lustral vase looked like, how it was made and how it operated, is shown in the accompanying illustration. The amount of money required to weight the lever



Lustral Vase from the Temple of Isis.

sufficiently to open the valve was about equivalent in value to 5 drachmæ, or, say, 75 cents of our money. From this it may be inferred that the worship of Isis was reasonably expensive.

The operation of the lustral vase is very cleverly chown in our drawing. When a 5 drachmæ coin was dropped through the slot *a* it fell on the flat disk at the end of the lever *b*. As the lever and valve were nearly balanced, the momentum of the coin in falling struck a blow upon the lever end, which for an instant unbalanced the valve and unseated it. The coin, however, did not lie upon the disk, but fell off into the large chamber of the vase. It served its purpose, however, as the momentary unseating of the valve allowed a few drops to pass through the valve opening *c*, fall into the space *e* and run out through

the tube *d*. The water in these vases was so extremely holy that it did not require very much to effect a great deal of purification—in one's mind.

The principle of the lustral vase was practically the same as that of the slot machine and the prepayment meter. Simple enough when understood, it was no doubt regarded as very wonderful by people sufficiently credulous to believe that dropping a coin into the vase was rewarded by a miracle. The ancient temples were full of devices of this sort, and the wisdom of the pagan priesthood consisted largely in knowing how to work clever impostures.

Among other things, Hero tells us that the heat generated by the burning of sacrifices on the altars was utilized to expand air or generate steam, by means of which movements were effected or things done without the apparent intervention of human agency. In this way automata were worked, sounds were produced, dragons made to hiss and breathe vapor, the doors of temples were opened or closed, and blowers to stimulate the fires were actuated. Hero tells all about these clever tricks, but as the printing press was not then in use his writings are more interesting to modern students then they were injurious to the priests. To guard against detection and exposure was essential to the safety of those who lived by fraud, and undue curiosity was punished by death or by very severe and discouraging penalties.

The next we hear of the slot machine was in Rome, where it was used to sell wine to the thirsty citizens, much as chewing gum, cigars, etc., are now sold. The gilded youth who wanted a drink went to the slot machine, dropped in the proper coin, held his goblet under the faucet, and so filled it. All of which serves to show that there is very little new under the sun in the way of mechanical principles or applications.

The prepayment meter is a very well constructed and extremely accurate instrument for measuring gas. A quarter dropped into the slot buys its value in gas, to be drawn when and as the consumer wants it. When the flow stops another quarter causes it to resume. There are probably 150,000 in use in this country, and the number is rapidly and constantly increasing. There is in every city a large floating population, residents of tenements and cheap apartment houses, who are very uncertain debtors and cannot safely be trusted. For such the prepayment meter is a boon. It has been instrumental in extend ing the use of gas where it could not have been introduced on any other basis, as well as where the companies could not on any other basis have afforded to distribute it. The testimony of gas superintend ents, without exception, is that it is perfectly satisfactory.

In New York and other large cities there has been some raiding of the cash boxes by "hoodlums," but this is possible only when the meters are in the cellars or public halls. The companies now refuse to put them in unless in such position that the gas consumers supplied through them can be held responsible for what goes into or comes out of them. This places an effectual check upon counterfeit coins, lead slugs and like expedients. Quarters with strings attached are frequently found, showing that the idea of using a coin and recovering it for use again has occurred to a great many people ; but as a quarter which has once opened the meter is not recoverable and stays in the cash box it amuses the collectors without injuring the companies.

One unexpected result of the substitutien of prepayment meters is that, in many cases, the monthly gas consumption is doubled, to the entire satisfaction of the consumers who had before been slow pay and great kickers. This is explained on the ground that the householder or shop keeper does not keep a very close watch on the quarters he puts in, and does not realize that he is paying more for his gas than he formerly did.

Scale in Boilers.

Mines and Minerals says there is, perhaps, nothing that gives an engineer greater annoyance than the formation of scale in boilers. This occurs, to a greater or less extent, according to the character of the water used in the boilers. The water supply in almost all mining localities is more or less contaminated with impurities, which result in the formation of insoluble salts, and these collect inside of the boiler, forming a scale which is often difficult to remove, and which has more than once been the direct cause of an explosion. There is no question upon which the engineer or the fireman in charge of boilers needs to be more thoroughly posted than that of the formation of scale in boilers. He should know what this scale is, how it comes to be formed, and how he can prevent it altogether, or get rid of it after it is formed.

The first of these questions can only be answered by a knowledge of the constituents in the water which is used as feedwater. The analysis of the feedwater will vary very much according to the locality. The salts most commonly impregnating feedwater are the sulphates of lime and magnesia, and carbonates of lime and iron. There is usually, also, a considerable quantity of organic matter held mechanically in the water. When the water is raised to the boiling point, in the boiler, the calcium sulphate ($CaSO_4$), or gypsum, as it is commonly called, held in solution in the water, becomes insoluble, and is deposited as a sediment in the boiler. This sediment, however, does not sink at once to the bottom of the boiler, but, owing to the agitation of the water by boiling, it floats freely, and coming in contact with the boiler plates, from time to time, adheres to them and forms what we have termed a crust or boiler scale. In like manner the calcium carbonate ($CaCO_3$) is soluble in water only because of the presence of carbonic acid (CO_2) in the water. That is to say, water containing carbonic acid gas can readily hold in solution, also, carbonate of calcium. When such water is boiled, however, the carbonic acid gas is driven off the same as we would drive out the air contained in water, by boiling. When the carbonic acid gas (CO_2) is driven off, by the boiling of the water, the $CaCO_3$ held in solution is deposited as a white sediment throughout the water. This sediment is held in suspension in the water, by the boiling action, in the same manner as the $CaSO_4$, previously referred to; but coming in contact with the boiler plates, it adheres to them, forming, likewise, a crust or scale. In the same manner, other impurities form sediment in the water, either through lack of solubility in the water, due to boiling, or, from the evaporation of the water as it forms steam. There is, evidently, a concentration of all the impurities contained in the feedwater within the boiler, forming a sediment and increasing continually the thickness of the boiler scale. This is true, also, of all the organic matter contained in the water. Scales will form more rapidly in a boiler according to the quantity of impurities which the feedwater contains.

Before considering how the formation of this scale may be prevented, or how the scale may be removed after it has formed, a few words in regard to the character and effect of the scale will be of interest. Scale will generally form more rapidly and be found to be hardest over the crown sheets, where the heat is strongest. This is due, perhaps, to the iron at this point being more expanded and very susceptible to the adhesion of the sediment in the water. It is, also, the most dangerous place for scale to form. The scale is a bad conductor of heat. This results at once in a higher temperature being required under the boiler to produce the same steaming effect within. This high temperature is generally attended by the blistering and warping of the crown sheets of the boiler, the heat being too intense. Usually the boiler plate is warped outward and toward the fire, so as to separate it in places from the hardened scale which has already formed upon the inside. The boiler plate becomes red hot, and the scale, suddenly cracking, allows the water to come in contact with the heated metal; this results in a very sudden generation of steam, and may be followed by an explosion.

An untold number of ways have been suggested for the removal of boiler scale. A quite common practice is to introduce sal ammoniac (NH_4Cl) into the boiler. A reaction takes place between the sal ammoniac and the carbonate of lime, according to the equation:

$$2NH_4Cl + CaCO_3 = CaCl_2 + H_2O + 2NH_3 + CO_2.$$

The calcium chloride formed is readily soluble in the water, and a great deal of it is carried over with the steam, while the carbonic acid and ammonia vapors are carried off readily, in the steam. These acid vapors, however, when this method is used, attack the iron of the boiler and corrode it rapidly. The same result is true of many of the other methods used. It has been also suggested to introduce common sawdust into the boiler, or any harmless material which would form nuclei for the sediment in suspension. This has a mechanical effect of preventing the adhesion of a large portion of the sediment to the plates of the boiler. The method, however, has not been widely used, as it has numerous objections, chief among which, is the carrying over of the sawdust or other material particles into the cylinder, and clogging the valves and pipes.

A remedy which we believe has been more largely applied, and which has been found to give general satisfaction, in almost every instance, is the introduction of common kerosene oil into the feedwater. The oil may be introduced directly into the tank from which the feedwater is drawn. It is, however, far more preferable to introduce the oil by means of a lubricator feed. There is such a feed, adapted to this special use, manufactured by the Detroit Lubricator Company. By this means the oil is fed regularly, in small quantities, into the feedwater, and becomes thoroughly mixed with the water instead of floating upon the surface as is common when introduced in

quantity into the tank. The amount of oil that is necessary to use varies with the purity of the feedwater. Thus, when the feedwater contains a large amount of impurity, a correspondingly larger quantity of oil is needed; but when the amount of impurity is small, there is not much oil required. In general practice, it is a common rule to allow 2 quarts per week per 100 horse power. It may be found, however, in any special case, that a less or greater quantity than this amount may be required.

This action of the oil is to prevent the formation of the boiler scale and not to remove it after it has formed. The oil does this by forming what might be called an emulsion or oily envelope surrounding each particle or grain of impurity in the water. This oily envelope prevents the adhesion of the grains of sediment to each other or to the boiler plates. The oil, also, has a beneficial effect in the cylinder, although it may be found necessary to change the cylinder lubricant. The action of the oil is always to "cut" out, as we say, any gum or rust forming in the parts of the machine. We believe that this last mentioned method for the prevention of the formation of boiler scale is the best in use, and should be tried by every one who is troubled in this direction.

Russian Petroleum Production in 1899.[1]

The report of Mr. J. C. Chambers, United States Consul at Baku, gives, as usual, very interesting particulars concerning the production of petroleum in that district for the year. The report says that the statistics show much more work done in 1899 than in 1898, with, however, less satisfactory results, as in 1898 the average daily production per well was 199 barrels, while in 1899 it was only 174 barrels. The increase in the daily average gross production in 1899 over 1898 was about 13,000 barrels, and, as the average number of wells producing was 212 more than in 1898, the increase in gross production per well was only 66 barrels per day, against 142 barrels in 1898. The production of the wells finished in 1899 was also much less than the production of the wells finished in 1898, as, while in the latter year the initial production of 258 wells finished averaged 653 barrels per well per day, in 1899 the production of 370 wells completed averaged only 202 barrels per well per day. This decline was principally due to the fact that there were fewer large flowing wells in 1899 than in the previous year, and cannot be considered to inidicate a very serious falling off in the territory, because those remarkably big flowing wells are possible at any time, and the result in 1900 may be quite as favorable as it seemed unfavorable in 1899.

Another feature of the production worthy of attention is the fact that, notwithstanding 456 wells were started drilling in 1898 and 598 in 1899, only 370 wells were completed in the latter year, and that, notwithstanding 370 wells were completed, there were only 223 more wells producing in December, 1899, than in that month in 1898. The facts point rather conclusively to the opinion that, unless some more of the former phenomenally large wells of previous years are struck in 1900, there is little chance of much increase in the production, because the limit of drilling operations possible has probably been reached; and with nothing more than the average wells of 1899 resulting from the new work, it seems unlikely that there can be a material increase in the production in 1900.

The figures for the average depth of the wells completed show only 911 ft. in 1899, against 937 ft. in 1898, and would seem to indicate that the drillling is getting shallower; but that is not the case, the decrease in the depth being due to the fact that more wells were drilled in the shallower older territory of Balakhani and Sabunchi, which wells are also smaller than wells in the newer and deeper territory.

The figures showing the loss from piping and consumption of crude for fuel at the wells give a better idea of the actual increase in production than the figures for the gross production, because the amount of crude thus consumed plays no part in the amount of production which enters into competition with the American product, and it can be readily understood that with crude the only fuel, as is the case at Baku, the increased number of wells producing and drilling increases the loss proportionately to the production unless there is a very material increase in the latter.

There is no doubt whatever that the cost of producing oil at Baku increases steadily; the expense of drilling new wells adds much to this cost, but the greatest increase in the cost is due to the increased depth from which the oil must be raised and the steadily increasing amount of water in the wells. It has been explained in previous reports that the Baku wells are not pumped in the same manner as in the United States; that, owing to the great amount of sand always combined with the oil, the American system of pumping is impossible; that the Baku wells are worked with the bailer; but it has also been explained that the bailer used is made as large as possible. If the well is finished with 16 in. pipe, which is very commonly the case, the bailer will be as great in diameter as possible to run inside that pipe, and generally about 40 feet long, so that it will bring up not much less than a couple of barrels at a run. The line used for runing the bailer is generally a wire cable, and has to be renewed in from 6 to 9 months. With this explanation it will be understood that the deeper the well the fewer the runs of the bailer, and that with water in the wells the less oil the bailer will bring up, as the water must be kept down, or it will eventually spoil the well. From excellent authority I learn that the water is confined to no particular part of the field, but is general, varying in quantity, however, in different wells. Some wells have so much water in them that it has been found unprofitable to work them; others having less water are worked by taking a bailer full of oil from the top, another full of oil and water mixed, from the middle, and a third full of water from the bottom of the well, making three runs of the bailer for not much more than one boiler full of oil. There are other wells with still less water which can be worked by taking two or three bailers of oil to one of water. While it is said that the water in the wells comes in from the shallower exhausted oil strata it is undoubtedly salt water, very similar to the water of the Caspian Sea.

The technical talent of the trade has been devoted for some years to finding some means of overcoming this very expensive difficulty, but wholly without success. The soil at Baku differs materially from the generality of soil in the oil regions of the United States, being loose and sandy from the top to the bottom of the well, and consequently offering no solid basis for packing; even if an American packer could be inserted, the water would not be long in working around it. Attempts have been made to shut the water off by pouring into the hole outside the pipe as much liquid cement as possible, which, when hardened, answered the purpose for a time; but the water eventually found its way around the cement.

There is still another condition which must eventually add materially to the cost of production—that is, the steadily increasing royalties which must be paid for territory. Royalties at Baku are always so much per pood (36 lbs.) on the oil produced, and not, as in the United States, a proportion of the oil itself. For years the average royalty paid was not more than ½ kopek per pood (about 2c. per barrel of 42 gals.); but the higher prices realized for some years for crude have caused a very great advance in the royalty, as the Government has leased much land in the last two years at prices of from 2 to 11 kopeks per pood (8 to 46c. per barrel), and always with the stipulation that a certain amount of royalty must be paid annually, whether oil is produced or not. Much of the drilling now being done is upon this Government land, and consequently as the new wells come in the royalty increases; in a few years this item will make a great addition to the cost of producing.

The fluctuations in the price of crude at wells were confined to between 11 and 13 kopeks per pood (70 to 80 per barrel of 42 gallons) the first half of the year, but advanced gradually till it reached 17 kopeks per pood (about $1.05 per barrel) in November, and has remained practically at that figure up to the present. Residuum was about 13 kopeks per pood (80 cents per barrel) at the opening of the year, and remained at about that figure till July, when it commenced to advance, and reach 15 kopeks (87 cents) in December, at which it may be quoted now. It will be seen that the highest prices for both crude and residuum were not reached until after the close of the season of Volga navigation, when, by reason of the impossibility of shipping by the Volga, the demand is greatly reduced, and residuum at least must be carried for several months till the shipping season opens; this would seem to indicate still higher prices when this season comes.

Up to the last four months of 1899 refining had for its principal object, as in the preceding year, fuel oil—residuum—as there seemed to be an almost unlimited market in Russia for that product at a good price, while the market for illuminating oils seemed to be falling off; and the price was hardly up to cost—in fact, was often below cost, and never up to a profitable figure. In the last four months of the year, however, when the advance in the price of American oil commenced to be felt, and the limit of price for residuum seemed to have been reached, conditions changed materially, and, with a high and steadily advancing price for refined oil, refining took for its principal object that product, which will be clearly seen by the following percentage statistics as to the yield of the various products for the year:

1. *Engineering and Mining Journal.*

Results of Refining.	Illuminating. Per Cent.	Lubricating. Per Cent.	Residuum. Per Cent.
First 8 months...	24.88	2.54	56.59
In September....	28.08	2.23	52.78
In October.....	29.17	2.98	52.8
In November....	31.38	3.35	48.96
In December.....	31.78	2.29	48.35
In the year 1899..	26.43	2.6	54.75

The statistics of the trade are given in the excellent tables which accompany the report.

The gross production of crude oil in the Baku District was as follows, in barrels of 42 gallons:

District.	1898.	1899.	Changes.
Balakhani-Sabanchi	34,608,346	41,488,801	I. 6,880,455
Romani.....	12,065,839	11,831,694	D. 234,145
Bibi-Eibat	11,584,216	9,700,897	D. 1,883,319
Totals	58,258,401	63,021,392	I. 4,762,991
Wasted and consumed for fuel.	4,858,724	6,883,969	I. 2,025,245
Net production.....	53,399,677	56,137,423	I. 2,737,746

The proportion wasted and used as fuel at the wells was 10.9 per cent. of the total production in 1899, and 8.3 per cent. in 1898.

The shipments from Baku for the year were, in gallons:

	1898.	1899.	Changes
Illuminating.....	473,205,000	515,835,000	I. 42,630,000
Lubricating.....	52,105,000	57,015,000	I. 4,910,000
Residuum.....	1,211,805,000	1,224,305,000	I. 12,500,000
Crude	219,460,000	121,430,000	D. 98,030,000
Totals.....	1,956,575,000	1,918,585,000	D. 37,990,000

Of these shipments from Baku in 1899 those by rail were 416,460,000 gals., or 21.7 per cent.; by sea, 1,502,125,000 gals., or 78 3 per cent.

The shipments of oil from the Black Sea ports in 1899 were as follows, in gallons:

	Batum.	Novorossisk.	Totals.
Crude and residuum	11,765,920	8,201,100	19,967,020
Lubricating.....	38,736,375	.....	38,736,375
Distillate.....	34 322,790	4,878,710	39,201,500
Refined.....	285,517,790	38,285,575	323,803,365
Totals	370,342,875	51,365,385	323,803,365

Concerning transportation, the report says that the export of Russian oil continues to be limited by the transportation facilities from Baku to the Black Sea. There are now two routes of shipment to the Black Sea, the first and most important being the railway from Baku to Batum direct, and the second by Caspian Sea to Petrovsk, and thence by the Vladikavkas Railway to Novorossisk. The latter route is much longer and necessitates transshipment from vessels to tanks at Petrovsk, and then from tanks into tank cars; consequently there must be greater loss than by direct shipment in cars to Batum. There is also a difference in the cost of transportation in favor of Batum, as the total freight to Novorossisk is about 22 6 kopeks per pood (11.6c. per 36 lbs.), against 16 kopeks (8.24c.) per pood from Baku to Batum; but this difference is considerably reduced by certain advantages given shippers by the Novorossisk route in excise allowance, so that the actual difference in favor of Batum is not more than 4 5 kopeks (2.3c.) per pood.

The object of the 8 inch pipe line for refined oil, under construction from the station of Mikhailova, on the Baku-Batum Railway to Batum, is to increase the capacity of the railway, the idea being to carry refined in tank cars from Baku to Mikhailova, and pump it thence to Batum. This will shorten the tank car haul the distance from Mikhailova to Batum (143 miles) and return, and, as that section of the railway is the most expensive to operate, because of the very heavy grades over the mountains, the saving in time and expense should be considerable; as to how much it will increase the capacity of the railway, opinions seem to differ.

The money for this pipe line was appropriated five years ago, when it was stated that the line would be ready for operation by the end of 1897. In the last report Mr. Chambers stated on good authority that the line could not be a factor in the transportation from Baku to Batum before the beginning of this year, and he now adds to that the assurance that the use of the line can not take place for another three or four months from date. The line was tested with water within the last tew weeks and found satisfactory, but now it has been decided not to commence the use of it until a number of self-closing valves can be placed in it for the purpose of protection against loss by breaks. From the top of the mountain, which is only a few miles from Mikhailova, there is a steady fall to Batum of probably more than 2,000 feet, so that without some preventative, in case of a break in the line near Batum, all the oil between the summit and the break would be lost; hence the idea of self-closing valves at intervals in the line.

The Westinghouse Electric and Mfg. Company's New Office Building.[1]

In 1894 the Westinghouse Electric and Mfg. Company removed from the city of Pittsburg to the site of their present works at East Pittsburg, 12 miles distant. The electrical business had surpassed all expectations and the old buildings were inadequate for the requirements of the expanding manufacture. A large tract of land was acquired at East Pittsburg, upon which new works were erected on a large scale, and were equipped with the latest machinery and labor saving appliances. The buildings were so designed that future extensions could easily be made without detriment to the existing plant. Last year the works again proved unequal to the expanding demand for Westinghouse electrical apparatus, more especially as the size of individual machines had increased until generators of 5,000 horse power have become frequent, and in some instances have reached to 8,000 horse power. Recent additions to the works already completed and those now in course of erection will bring the floor space to 500,000 square feet, equal to 11½ acres.

When East Pittsburg was selected for the site of the Westinghouse works it was proposed to erect a separate building for offices, but as a temporary resource part of the second floor of one of the manufacturing buildings was appropriated for office purposes. Of course the conveniences for office work were not of the best, and as the staff grew in size this temporary arrangement presented greater difficulties, but the experience gained as to actual office requirements was valuable in arranging the permanent building.

About a year ago it was determined to erect a structure for permanent offices, which should be of sufficient size to afford accommodation for the staff of the numerous departments of the business. The architectural features and the general arrangement have been under the supervision of George Westinghouse.

This building has just been completed. It faces Cable street and abuts on Braddock avenue, stretching across the end of the main works. It is conveniently situated for access from the East Pittsburg station on the main line of the Pennsylvania Railroad. The dimensions are 250 feet with a depth of 50 feet, with 7 stories. The material used is Vamport brick of a buff color, specially made to harmonize with the Beaver Valley stone facings, the walls being carried up 5 feet above the ground with rock faced stone. The entire building is fireproof, rows of steel columns being carried longitudinally through the center. The floors and partitions are of terra cotta, the former being built with arches, above which are mud sills bedded in concrete. The mosaic and wood floorings rest upon the beams and sills, and as the intervening space is filled with concrete, the sound from one floor to the other is thoroughly deadened. The roof has a very high pitch, and is constructed entirely of steel trusses with iron purlins, to which the slate is fastened with copper nails. At the ends of the building and in the center, Gothic gables and dormer windows in the roof add greatly to the attractiveness of the outline. The partitions between the offices are of terra cotta, covered with adamant plaster.

Immediately within the entrance at the southwestern extremity of the building is the employment office, where operatives for the works are engaged. Further along on this floor are extensive storerooms for the small parts and supplies used in the construction of electrical apparatus. There is also an office for the storekeeper and his clerical staff. Near the center of these offices is a switchboard from which the electric current for lighting the building and for the elevator pumps is controlled. The very interesting machinery which operates the elevators is upon this floor. The eastern extremity of this floor is spanned over for the railway entrance to the works. Freight cars from the Pennsylvania Railroad main lines are brought direct into the works for delivering foundry castings and other material, and for loading the finished electrical apparatus. Mounting the mezzanine floor, the works' office is entered. Upon either side of the central passage are offices devoted to the superintendent, engineer of works, the construction department and the production department.

A novel feature has been introduced by devoting the entire end of the building, abutting upon Braddock avenue, to fire proof vaults. Twenty-four feet from the outer wall a fire proof brick wall is carried upward from the foundation to the roof, forming fire proof vaults upon the several floors, each having an area of 1,200 square feet. Entrance

1. *Iron Age.*

to these six vaults is through two sets of double fire proof iron doors on each floor. The vaults are for the safe custody of the valuable plans and blue prints of electrical machinery, the general books and records of the company, and for the large collection of negatives, photographs and electrotypes.

Upon the second floor near the elevator is a handsome reception room for visitors, comfortably furnished, and to the right a door opens upon the suite of rooms devoted to the managers and their assistants, including rooms for the president, vice-president, acting vice president, the manager of works and for the clerical staff of this department. These rooms are well furnished, but without any lavish display, the general tone and coloring of the appointments giving an impression of good taste and serenity. The consultation and reception rooms are substantially furnished; the toilet rooms are finished with white marble. To the left of the entrance lobby are the general business offices, those of the sales manager and sales department, and of the domestic and foreign correspondence departments.

The arrangement of the third floor is similar to that of the second. The suite of offices to the right are occupied by the Westinghouse Company's publishing department and the purchasing agent and his staff. To the left from the hallway are the accounting offices, those of the auditor and his staff, the paymaster, the assistant treasurer, and the offices of the legal department and of the cost department.

The arrangement of the fourth floor differs from those below by the omission of the central corridor. The entire floor is occupied by the mechanical engineering department and by the draftsmen. The fifth floor is similar to the fourth, and the electrical engineers are housed on this floor. Upon the sixth floor are two dining rooms, handsomely wainscoted with mahogany, the upper walls being tinted. Adjoining them is an ample kitchen and butler's pantry. One of the rooms of this floor forms the "Central" for the telephonic system and another serves as a dining room for the female stenographers.

The ventilation of the building has had great care. Upon the sixth floor under the roof is a large horizontal ventilating shaft running from end to end of the building, flues connecting each room with the main shaft. An electric motor operates a Sturtevant fan in the center of the main shaft, which during the winter expels the vitiated air, driving it above the roof. Fresh air is admitted into the offices by a part of the heating system, passing through shafts in the wall behind radiators, which heat the air as it is admitted. The building is amply lighted throughout by electricity, the current being obtained from the central power house of the company.

The heating of the building is by direct radiation, using steam from two 50-horse power tubular boilers installed upon the ground floor. From the boiler the steam is conveyed to the top of the building by mains which extend horizontally above the sixth floor. When leaving the main the steam passes through a valve reducing the pressure from 15 pounds to 1 pound, and is then carried by risers to the radiators on each floor. An idea of the extensive nature of this heating system may be gathered from the fact that there are nearly 50 radiators on each floor, having 8,000 feet of radiating surface. Thermostatic valves automatically govern the temperature. When a certain amount of steam is admitted the heat expands the joints, closing the valves and cutting off the steam, and when the temperature falls the valves reopen, admitting a further supply of heat. A Warren-Webster vacuum pump removes the condensed water from the radiators and pipes, and an electrically driven pump passes it to the boiler.

Large and ample toilet rooms are provided in every story. The floors are tiled, and white marble is used for the wainscoting, partitions and washstands, the latter being supplied from the boiler room with hot and cold filtered water. The open plumbing follows the latest approved methods, and great care has been taken with the ventilation and sanitary arrangements.

The two passenger elevators were supplied by the Crane Elevator Company. They have a traveling distance of 72 feet from the ground to the sixth floor, each one being rated to carry 1,500 pounds 400 feet a minute. They are operated upon the electro-hydraulic system, the mechanical plant being upon the ground floor. The hydraulic apparatus includes two large water tanks, one of them containing water under pressure. Two Westinghouse type "C" motors operate the pumps which force the water from the low pressure to the high pressure tank. As soon as the pressure is reduced to 100 pounds, by using the elevators, a weight falls which automatically closes the switches, and the electric motors commence to drive the pumps until the pressure in the tank is raised to 140 pounds, when the switches open automatically and the motors stop. As the water leaves the high pressure tank it returns to the other one, and is thus used over and over again. To control the stoppage of the elevators when reaching the two extremes of their journey there is a Crane cut off valve, so that should the operator inadvertently fail to move the lever, the car slows down and stops automatically. Also a further protection is provided by a Crane safety clamp for stopping the elevator in case of accident to the hoisting cables. If the downward speed should reach 450 feet a minute, a lever is automatically thrown out which trips a powerful spring below the car, causing the clamps to press strongly upon the guides on each side, and the car is stopped by friction.

Probably the most novel feature of the recent improvements made in this establishment is the system of pneumatic tubes, whereby all works departments and all of the offices are connected through a central exchange station. The central station of the pneumatic system is upon the second floor, and contains 12 sending and receiving tubes, furnishing service to all floors of the office building and to the important points in the works. The tubes are of 2¼-inch brass, the longest line being 3,500 feet, the circuit of which can be made in from 40 to 45 seconds, or at a speed of about a mile a minute. The system is operated by a positive exhauster of the Connersville type, which, exhausting the air from the tubes, allows an inrush of air from the atmosphere, forming the pressure that propels the carriers and their freight to their destination, where they are discharged through an air valve which immediately closes, thus forming the circuit back to the starting point. The pressure of vacuum maintained is about 24 ounces, which is capable of handling a carrier and load equal to 8 pounds at the speed mentioned above.

All the mail and other matter is thus distributed in a very much shorter time than it can be delivered by messengers.

Incandescent Gas Lighting in London, England.

The *Gas World* says that it is from 1888 the electricians date their emancipation from the toils of restrictive legislation, and the same year may be said to mark the introduction of practical incandescent gas lighting. When the Electric Lighting Act of 1888 was passed we were told that the days of gas lighting were numbered by a very brief term of years. Time tests all prophecies, and at the end of 12 years we find more gas lighting than ever before. It is not our present object to inquire what the result would have been to-day had Welsbach not made his great discovery. For the moment we are concerned with the facts as they stand, and not with speculations as to what might have been. The casual observer can see for himself that even the flat-flame gas burner is holding its own against the electric lamp, and also that where the electric lamp was expected to hold sway the incandescent gas burner is very much in evidence.

The South Metropolitan Gas Company took the lead in promoting the use of incandescent gas burners for street lighting in London, and a representative of the *Gas World* was informed by Mr. Carpenter, the Chief Engineer of the Company, that there are now in the Company's district between 13,000 and 14,000 street lamps fitted with incandescent burners. According to the Company's last published accounts the total number of street lamps in the district is 21,063, so that between 60 and 70 per cent. of the total are fitted with incandescent gas burners. And this change has been effected in a little over a year, for it was not till the end of 1898 that the directors submitted to the vestries the scheme which has now practically revolutionized the public lighting of South London. The offer of the Company to the vestries was to convert all the street lamps to the incandescent system at its own cost, and to trust to the saving in gas consumption for repayment. This offer was accepted by nearly all the lighting authorities, with the result just mentioned.

Up to 1898 the bulk of the street lighting was done by flat-flame burners consuming 5 cubic feet of gas per hour, and an inclusive charge of $15.93 per annum was made for each of these. It was reckoned that by the use of the No. 2 Welsbach burner there would be an annual saving consumption equivalent, at the then price of gas, to $2.93 per annum, and upon this basis the Company undertook to find the money for the first cost of the conversion of the lamps. The exact terms of the scheme are set forth in the following extract from a letter addressed to the vestries by the Company: "The Company will advance the money without interest, and will accept as payment the saving affected, the parish paying, until the cost is recouped, the present price of $15.93 for all the new lamps fitted, except in the main roads (Paris lanterns), which will be charged at $18. The Company will keep exact accounts, which will be open to the parish at any time, and an annual statement shall be rendered. In the event of a reduction being made in the price of gas or any other saving being effected,

the parish shall have the full benefit." As matters have turned out, one advantage that the vestries who accepted this offer are now enjoying is immunity from the recent increase in the price of gas. It may be mentioned that in connection with this scheme the South Metropolitan Company has devoted considerable attention to the design of lamp posts, and has now adopted a pattern designed by the Chairman, Mr. George Livesey. So far the South Metropolitan Gas Company has employed the Kern burner and Welsbach mantle, but they are just about to fit one street with the Sunlight burner and mantle.

But the directors of the South Metropolitan Gas Company are not content to stay their hands at street lighting. A beginning has been made in supplying incandescent burners for indoor lighting; and in this departure the penny-in-the-slot consumer is not being neglected. The Company are now supplying one "C" Welsbach burner to the prepayment consumer who desires it, without any extra charge. The burner is fixed and the first mantle is supplied, and after that the consumer is left to supply his own mantles. Then the Company have made a start with ordinary indoor lighting by means of incandescent burners. The Camberwell Art Gallery and the Camberwell Vestry Hall are instances of this. In both these cases the Company provided the installation at the cost of the authorities, and keep the same in order at a fixed charge. "In both cases," Mr. Carpenter told our representative "there were complaints as to the lighting and as to the heat produced, and it was proposed to introduce the electric light, and in each case the substitution of the incandescent gas light has proved a great success."

The Gas Light and Coke Company are also encouraging the use of the incandescent burner for street lighting, but in a different manner. They convert the street lamps to the incandescent system, providing everything from the top of the lamp post, and spread the cost over a period of five years. The first cost of conversion, with a No. 4 Kern burner (the smallest employed by the Company) is about $10, and afterwards there is a maximum charge for renewal of mantles, which has been fixed on the basis of eight mantles per year. That is to say, the Company maintains the lamps in proper condition at a maximum charge of eight mantles per annum; if the number is less than eight the actual number is charged for; if it is more than eight only eight are charged. The Westminster district is entirely lighted under this system and arrangement, and even in St. Pancras—where there is electric light supplied by the vestry—the system is finding favor for lighting side streets, where the use of the electric light is admittedly too costly.

The Consular Service.

Iron Age says that a most interesting contribution to the perennial discussion of the consular service of the United States has been made by George F. Parker in the *Atlantic Monthly* for April and May. Mr. Parker is well qualified for such an undertaking by five years' service as Consul at Birmingham and a previous journalistic training. He therefore understands thoroughly what he is writing about and knows how to express himself. Without asperity, evidently having no grudges to feed, he carefully analyzes the work done by our consuls, points out that which is commendable and should be continued, sets forth much that should be eliminated from their duties and suggests a practical reformation of the service. We shall not attempt in the brief space permissible for this article to take up all the important points made by Mr. Parker, for that would involve the reproduction of almost his entire paper, but will merely allude to a few of the most striking.

Much useful information, he says, is furnished to home manufacturers, but it is not always appreciated, in many cases not even acknowledged. No consul would think of making a charge for it, but many persons at home have yet to learn that there is such a thing as good manners in business. This is something for our manufacturers to bear in mind when they write to any of our consuls for some special information.

It is the general presumption that because our consular service represents appointments made amost wholly as rewards for party service, it is therefore inefficient. Mr. Parker says that taken in its entirety it reaches a good average of efficiency, higher than that of most countries. Although the Secretary of State, theoretically, appoints consuls and supervises their work, he does neither. The work is supervised by the chief of the Consular Bureau, who is usually a clerk trained in the department. Although nearly everything that a consul does concerns the Treasury Department, all communications must pass through the Consular Bureau, causing great delays in receiving information of changes in tariff laws, etc. He recommends that the supervisory authority be made of much more importance.

Mr. Parker strongly condemns the report system in vogue, including the daily advance sheets sent to newspapers. He says there is no room for this flood of commonplace writing nor for the fortieth part of it. He says, for instance, that for the past ten years many consuls, in every part of the world, have been writing about American machinery and tools, but, in spite of this, not even one report furnished real and new information on the outlook, a result due less to lack of knowledge than to the narrowness and shortness of view incident to the man who writes from the observation and experience of a district with perhaps a single industry.

He says the consular service belongs logically to the Treasury Department, being concerned almost wholly with commerce. But the Treasury Department is overwhelmed with work. If a Department of Colonies or Commerce should be organized, the service might be transferred to it to become the chief corner stone of a new executive department rather than remain the neglected or rejected of the diplomatic builders.

He argues in favor of the abolition of the consular invoice, which is both inquisitorial and ineffective as a method for determining values at the place of origin or manufacture. When merchandise arrives at its destined port, an elaborate and expensive system of appraisement is maintained for determining values. If no question is raised, the consular invoice becomes a simple bill of lading and is therefore unnecessary. In a dispute, it counts for nothing.

The scheme of reorganization which he outlines provides for consuls-general, for consuls of two classes, for vice-consuls of two classes, for an exclusively American clerical force as the staff, and for student interpreters in Eastern countries. In Great Britain, for instance, now having more than a hundred commercial representatives, he would reduce the number to less than half, placing a consul general in London, consuls in Birmingham, Liverpool, Manchester, Bradford, Glasgow and Belfast, and vice-consuls at ten other points tributary to these as trade centers, abolishing all consular agencies held by foreigners. Each country or in some cases groups of countries would be provided with a service of this character but varied according to conditions. Appointments would be made to vice-consulates of the lower grade and promotions thence to the higher grades. As the terms of those with consular rank expired, or as they died or resigned, the President would fill the vice-consulate vacancies without the necessity of sending the names to the Senate for confirmation. No inexperienced man could thus be appointed to the higher grades. He does not recommend an examination for applicants, but makes very practical suggestions on this point. The tenure of office he would limit to one year for the service of vice-consuls on probation and six additional years in the various grades through which they may pass.

The consuls thus appointed should be given opportunities to visit American industries akin to those in their districts and be required to visit the principal places in their districts every year for the purpose of studying with care the manufacturing, commercial and agricultural interests, so as to be able to report on them, when necessary, in no chance or haphazard way. The consuls, relieved from useless office drudgery, with efficient staffs of assistants drawn from home, Mr. Parker believes, would thus be able to do their work with system and intelligence. The reports then made would be of value. He suggests plans for the preparation and publication of such reports.

Mr. Parker's paper should be read, and its statements and recommendations weighed carefully by all who are interested in the improvement of our consular service. We have now arrived at such a point in our industrial development that we are building up a great export trade in manufactured products. Through our consular service, properly organized and constituted, the efforts of our manufacturers could be greatly assisted in ascertaining the conditions existing abroad and the necessary measures to develop and hold their export trade. That service should be made a far more valuable adjunct to our commercial system than it now is.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

"OBSERVER," writing under date of the 8th inst., says: "The Excise Tax Bill, now before the Massachusetts Legislature, is perhaps one of the most unjust bills ever brought before that body, and one wonders how it came as near receiving the unanimous vote of the committee; only one member objected. The bill proposed to tax all public service companies distributing gas, water, steam, electricity, oil, or telegraphic or telephonic electricity to the amount of one per centum of their gross receipts, if their dividends aggregate 6 per centum annually and one-half per centum additional for every one per centum additional dividend over 6 per centum. Notwithstanding that this is double taxation, for such companies are now taxed on the selling price of their stock, which usually exceeds its par value, and which difference is fairly considered a franchise tax, and notwithstanding that Massachusetts now exempts street railway, etc., companies till they have reached an 8 per cent. dividend, it is feared the bill will pass the House.

The Committee on Manufactures gave a hearing this week on the recommendation of the Board of Gas and Electric Light Commissioners

that the charter of the Securities Company, of Haverhill, be revoked. This is the Company which issued $500,000 bonds and $500,000 stock, and with the proceeds of the sale of the bonds purchased the stock of the Haverhill Gas Light Company, worth according to Mr. Barker, the Chairman of the Commission, some $350,000. Mr. Barker submitted a bill which provides for the annulment of the charter. He claimed that the Company in issuing its securities evaded the laws of Massachusetts, and multiplied them with the intention of foisting them upon the public.

The 80 cent price for gas evidently was made to prevent the putting out of these securities, and it has certainly done so effectually. If now some assurance can be given the public that a reasonable capitalization will be maintained, it is hoped the affair will be closed, and that the ridiculous demand for 80 cent. gas will be forgotten.

The 75 cent gas hearings for Boston have been closed. Mr. R. M. Morse argued for the Boston companies that such a price was absurd, and that if it were enforced the companies could not pay operating expenses. Mr. W. M. Butler argued for the New England Gas and Coke Company along the same general lines. Mr. Parker C. Chandler, for the Bay State Gas Company, donned the cap and bell, and gave his usual performance, and Mr. Anderson argued for the petitioners. The committee took the matter under advisement. It is not expected that a report will be made in favor of the reduction.

The petitioners who asked for a general investigation of gas companies and the selling prices of gas throughout the State were given leave to withdraw.

The bill to give New Bedford 80 cent gas was referred to the next General Court.

The petition of Mr. S. B Pearmain, requiring gas companies to make more complete returns, was heard, argued and defeated. It seems as if the returns were complete enough to satisfy almost anyone. Indeed, the annual report of the Commission is sufficiently complete to be used as a text book in any school of gas engineering. No further action has been taken in the various hearings.

Possibly the recounting of matters at the State House is tedious, but at present all the Massachusetts gas people are anxiously watching the Legislature and take little interest in other matters.

At the annual meeting of the Clarksville (Tenn) Gas Light Company the officers chosen were: Directors, A. Howell, H. C. Merritt, D. N. Kennedy, B. H. Owen and J. T. Kennedy; President, A. Howell; Treasurer, D. N. Kennedy; Sec. and Supt , B. S. Reynolds.

Mr. Sanford E. Gillette has been appointed Engineer to the Marblehead (Mass.) Gas and Electric Light Company.

The Marblehead (Mass.) Company has established new business offices in the Teshew building, 106 Washington street. In addition to the accounting department the Company will there maintain show rooms for the display of a full line of the latest appliances for lighting, cooking and heating by gas.

At the annual meeting of the Union Gas and Electric Company, of Waterville, Me., the officers elected were: Directors, Chas. F. Johnson. Frank Chase, Edward Ware, Nathaniel Maeder, Fred. Porter, J. S. Bangs and A. F. Drummond; President, C. F. Johnson; Treasurer. N. Maeder; General Manager, Frank Chase.

At a meeting of the Board of Directors of the New Haven (Conn.) Gas Light Company, held early this month, a resolution to rearrange the capital stock was adopted. Under the resolution the capital is to be increased from $1,000,000 to $1,250,000, and the new stock is to be issued to holders of record at par proportionate to their holdings. Our informant further says that the "increase of stock was deemed advisable to provide for new and important enlargements to the Company's plant."

The Stacey Manufacturing Company, of Cincinnati, O., has opened an Eastern office in the Drexel Building (911), Philadelphia, Pa.

A correspondent at New Orleans, La., says that the Citizens Electric Light and Power Company, of Baton Rouge, La., has gone out of business, its railway and electric lighting plants having been purchased by the Baton Rouge Electric and Gas Company, the proprietorship of which is vested in Senator John D. Fisher.

The Santa Barbara (Cal.) gas and electric light plants have been purchased by the controllers of the United Electric, Gas and Power Compuy, the headquarters of which concern are in Los Angeles.

The gas and electric lighting plants of Dansville, N. Y., have been amalgamated under the title of the Dansville Gas and Electric Company. The executives of the new enterprise are: Directors, E. F. Hizer, J. A. Jackson, E. L. Smith, S. N. Blake, G. A. Sweet, J. M. Edwards and B. H. Oberdorf; President, E. F. Hizer; Vice President, J. A. Jackson; Treasurer, S. N. Blake; Secretary, E. L. Smith.

Mr. J. P. Airy, who is President of the proposed Gas Company for Durango, Col., says that that plant will be constructed this summer.

The latest manifesto that we have concerning the rate war in Peoria, Ills., is in the shape of the following notice, issued over the signature of Mr. F. W. Little, Vice-President and General Manager of the Peoria Peoples Gas and Electric Company, dated the 1st inst.: "We learn that a rumor is in circulation that the Peoples Gas and Electric Company, or some of those interested in that Company, are behind or in some way connected with the recent alleged transfer of a controlling interest in the Peoria Gas Light and Coke Company. This rumor is wholly and absolutely without any foundation whatever. The Peoples Gas and Electric Company is selling gas at 40 cents per 1,000 cubic feet, with a discount of 10 cents per 1,000 for prompt payment, making net price 30 cents. This price will be maintained as long as the Peoria Gas Light and Coke Company sells gas at 50 cents." Our belief is that the Peoria Gas Light and Coke Company will be selling gas at a fair price for years to come, and our further knowledge is that the greater the quantity of gas that the Peoples Gas and Electric Company sells at 30 cents the sooner will it sue for peace.

In connection with the Peoria situation it might be well to remark that the control of the old Peoria Gas Light and Coke Company has passed to a syndicate that dictates the policy of the Decatur, Quincy and Joliet (Ills.) Companies. The new President, General Manager and Superintendent is Mr. Abner McKinley; and its Treasurer and Secretary is Mr. George A. McComber, of Augusta, Me.

The reorganization of the gas and electric lighting interests of Sandusky, Ohio, has been completed. The new concern is to be known as the Sandusky Gas and Electric Company, and its affairs are to be managed by the following Board of Directors: George R. Cutter, C. D. Barney, John Whitworth, George Feick, John Homegardner, Emil G. Schmidt and Samuel R. Bullock.

Messrs David Koch, A. H. Slayman, Frank Hastings, W. L. Shellenberger and Clyde E. Brown have applied for a charter under which they propose to operate an opposition lighting plant in Altoona, Pa. The incorporating papers declare that they propose to "manufacture and furnish gas for light, heat and power" in Altoona. The name of the concern is the Peoples Light, Heat and Power Company.

The Philadelphia *Press*, of May 8th, reporting the action at the annual meeting of the United Gas Improvement Company says: "The annual meeting of the stockholders of the United Gas Improvement Company was held yesterday, and the only business transacted was the reading and acceptance of the annual report, and the election of the old Board of Directors: Thomas Dolan, President; George Philler, William L. Elkins, P. A. B. Widener, Clement A. Griscom, William W. Gibbs and Samuel T. Bodine. The annual report refers to the growth of the Company during the year and gives the list of a number of Companies, controlling interest of which has been acquired. These include all the electric and gas light companies of Hoboken, Elizabeth and a number of surrounding New Jersey towns, and companies in Yonkers, and a number of other towns adjacent to the city of New York. The Company has also acquired properties in Connecticut. To provide the funds for the payment of these properties an issue of stock of $7,500,000 was made, as is known, which was all subscribed and of which $6,800,735 has already been paid in. During the year 1899, he rebuilding and extension of the manufacturing and distributing plants of the Philadelphia gas works have been continued. For the twelve months ending December, 1899, there was expended upon the Philadelphia gas works on improvements, betterments and extensions, $2,473,648.28, divided between the manufacturing plant and the distributing system, bringing the total expenditures on this account from the beginning of the lease to December 31, 1899, to $5,617,810 37. Adding to this the appraised value of the plant of the Philadelphia Gas Improvement Company, which reverts to the city at the end of lease, we have a total increase in the value of the Philadelphia gas plant of $6,677,810.37. 'To-day,' the report says, 'the Philadelphia

(*Concluded on page* 778.)

(*Continued from page 777.*)

gas works, in physical condition, is equal to any gas works in the United States. The quality of the gas supplied and the methods of conducting the business have been certified to in the first annual report of the Inspector of Gas and Meters as more than complying with the engagements of the lease.' The financial statement of the United Gas Improvement Company for the year ending December 31st, 1899, shows the net cash profits to have been $4,948,923.40, notwithstanding the fact that the increase in taxes and in the cost of materials used in the manufacture of gas amounted to $325,000, as compared with the prices of 1898. In addition to this it may be noted that there were placed in the Company's treasury, all practically within the last fiscal year, various shares and bonds of gas and electric companies, the present market price of which is $6,500,000 more than their cost to the Company, which, however, in accordance with the Company's settled policy, are carried on the books at cost. The profits of the past year are the largest in the Company's history. The cash profits not divided among the shareholders or expended on extensions of your various properties, together with the fund received from the increase of the capital stock, were invested or are required for investment in the New York and Connecticut properties referred to."

At the annual meeting of the Chester (Pa.) Gas Company the officers elected were as follows: Directors, Samuel A. Crozer, Stephen Cloud, Jr., J. Howard Roop, C. Deshong and E. Barton Johnson. President and Treasurer, J. Howard Roop; Secretery, E. Barton Johnson.

The Market for Gas Securities.

Weakness with inactivity marked the course of the market for city gas shares last week. No developments in the local situation came to the surface, unless it may be said that Mr. Russell Sage's final retirement from the local gas field counts as such. He was not named to serve on the Standard Company's Board of Directors at the annual meeting. City gas shares, outside of Brooklyn Union, were all affected with the slows. Consolidated closed to day (Friday) at 181 to 183. Standard common was 105 bid; Mutual was 285, and New Amsterdam, was estimated worth 27.

The situation in respect of the general market looks to favor the investor, although Peoples Gas, of Chicago, is a weak spot, being quoted to-day at 100, ex div. of 1½ per cent. Baltimore is in good demand, and all the evidence favors the fact that it is a purchase.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 Wall Street, New York City.

May 14.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$54,595,200	100	181	183
Central Union, Bonds, 5's.	3,000,000	1,000	103½	105
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	275	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	27	28
Preferred	10,000,000	100	50	52
Bonds, 5's	11,000,000	1,000	96	97
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	115	..
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	100	116
Preferred	5,000,000	100	125	140
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	114
Yonkers	299,65	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	147	150
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1¼	1⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	35
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	6
" " Bonds, 5's	5,250,000	1,000	69	71
Central, San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,090	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	200	200½
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	.	..
Consolidated, Baltimore	11,000,000	100	55¾	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	19
" Con. Mtg. 5's	880,000	1,000	82	86
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,560,000	50	95¾	96
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	886,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	101	103
" Bonds, 6's	2 650.000	..	100	104
Jackson Gas Co	250,000	50	72	78
" 1st Mtg. 5's	250,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	35	40
Bonds, 1st 5's	3,822,000	1,000	101½	103

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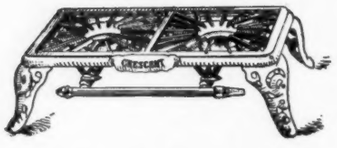

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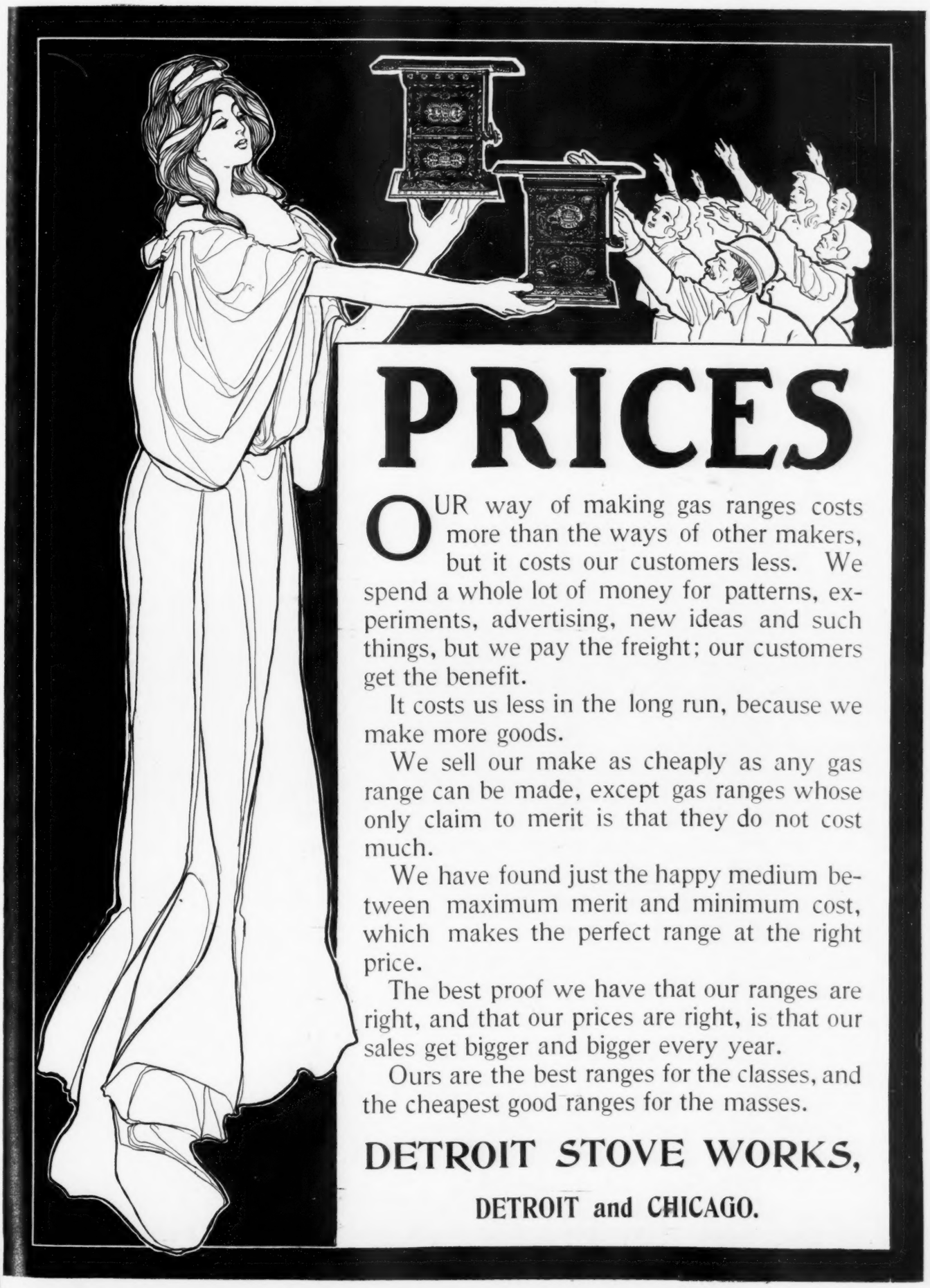

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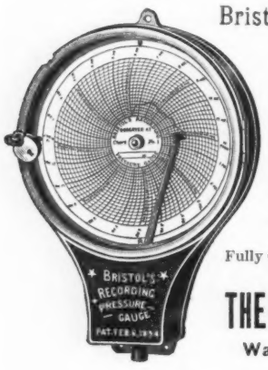

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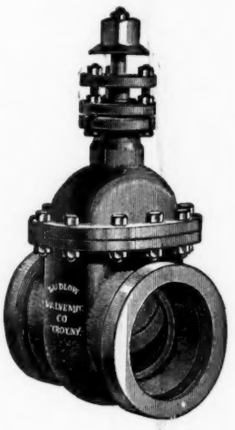

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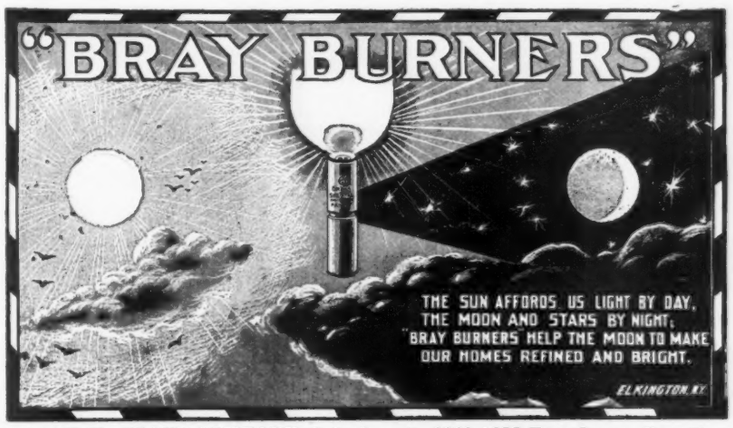
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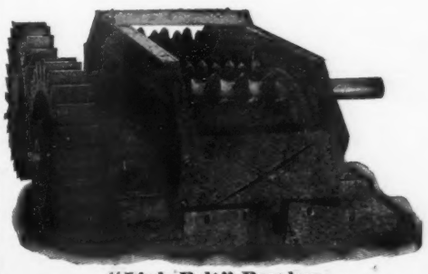

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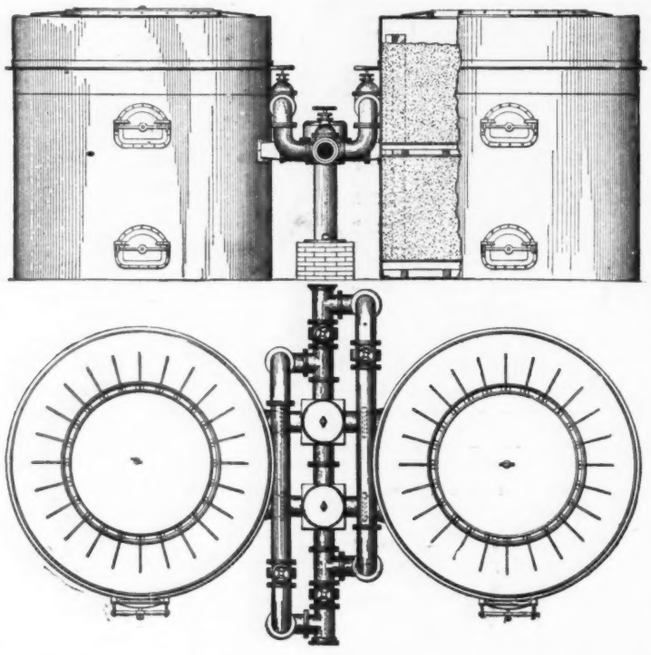

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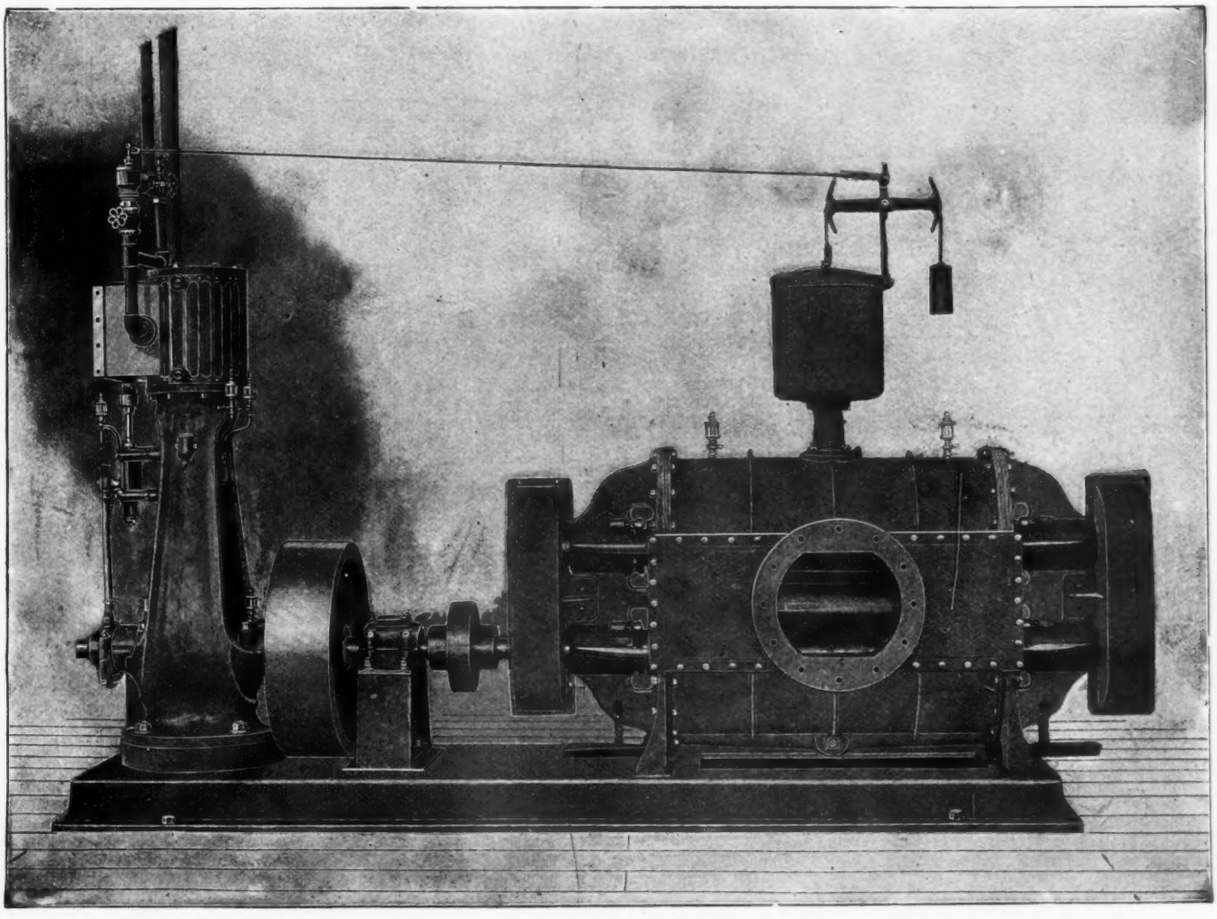

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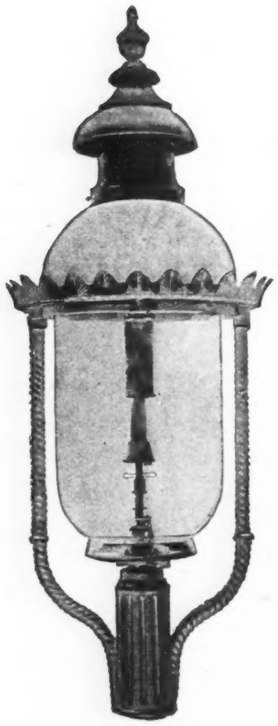

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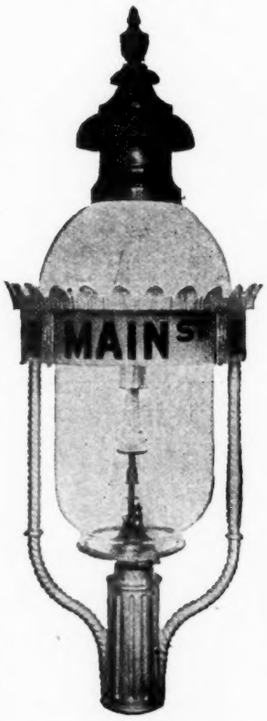

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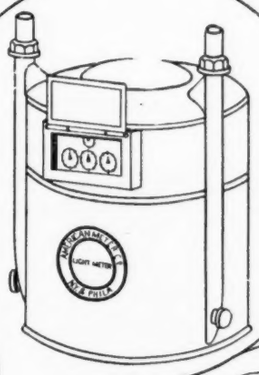
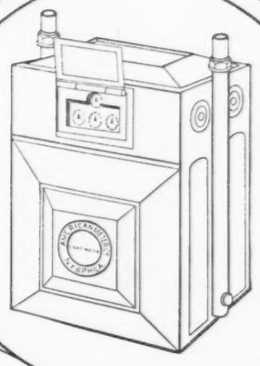
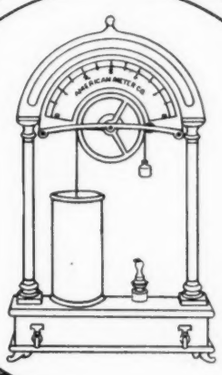


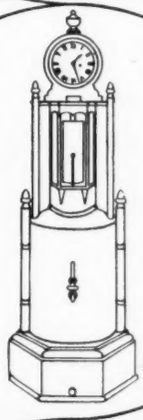


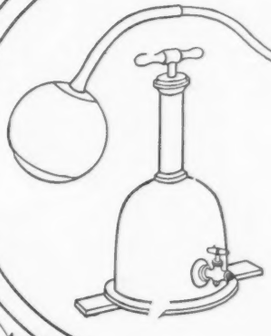
PUBLIC LIGHTING TABLE.

MAY, 1900.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Tue.	1	7.20 PM	4.00 AM	6.45	4.00
Wed.	2	7.20	4.00	6.45	4.00
Thu.	3	10.30	4.00	6.45	4.00
Fri.	4	11.10	4.00	6.45	4.00
Sat.	5	11.40	4.00	6.45	4.00
Sun.	6	12.10 AM FQ	3.50	6.45	4.00
Mon.	7	12.40	3.50	6.55	3.40
Tue.	8	1.00	3.50	6.55	3.40
Wed.	9	1.30	3.50	6.55	3.40
Thu.	10	1.50	3.50	6.55	3.40
Fri.	11	2.20	3.50	6.55	3.40
Sat.	12	2.50	3.50	6.55	3.40
Sun.	13	No L.	No L.	6.55	3.40
Mon.	14	No L. FM	No L.	7.00	3.30
Tue.	15	No L.	No L.	7.00	3.30
Wed.	16	7.40 PM	10.20 PM	7.00	3.30
Thu.	17	7.40	11.10	7.00	3.30
Fri.	18	7.40	11.50	7.00	3.30
Sat.	19	7.40	12.30 AM	7.00	3.30
Sun.	20	7.40	1.10	7.00	3.30
Mon.	21	7.40 LQ	1.40	7.10	3.15
Tue.	22	7.40	2.10	7.10	3.15
Wed.	23	7.40	2.40	7.10	3.15
Thu.	24	7.40	3.20	7.10	3.15
Fri.	25	7.40	3.40	7.10	3.15
Sat.	26	7.40	3.40	7.10	3.15
Sun.	27	7.50	3.30	7.10	3.15
Mon.	28	7.50 NM	3.30	7.15	3.15
Tue.	29	7.50	3.30	7.15	3.15
Wed.	30	7.50	3.30	7.15	3.15
Thu.	31	7.50	3.30	7.15	3.15

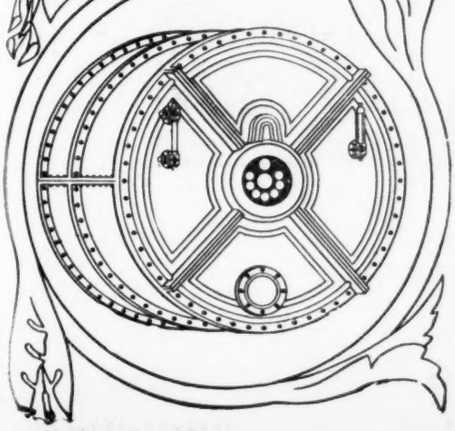


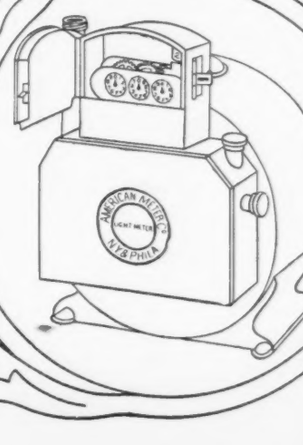




TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	230.50	January	423.20
February	175.40	February	355.25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152.00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr.	2221.40	Total, yr.	3987.45





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THE STANDARD JUNIOR,

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LOWE WATER GAS APPARATUS.

Total Sets Installed to January 1, 1900, - - - - - - - - 327

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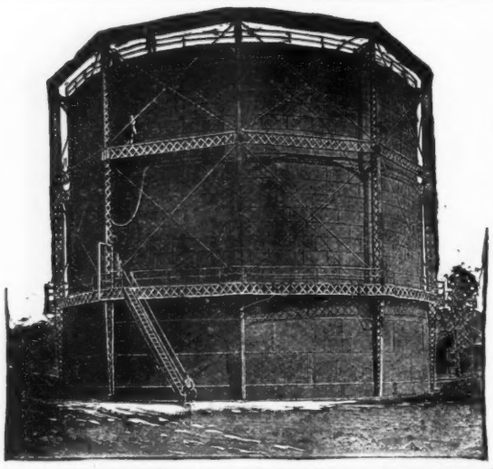

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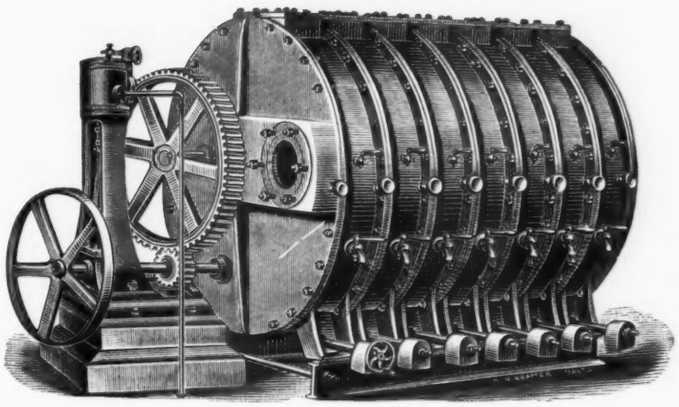

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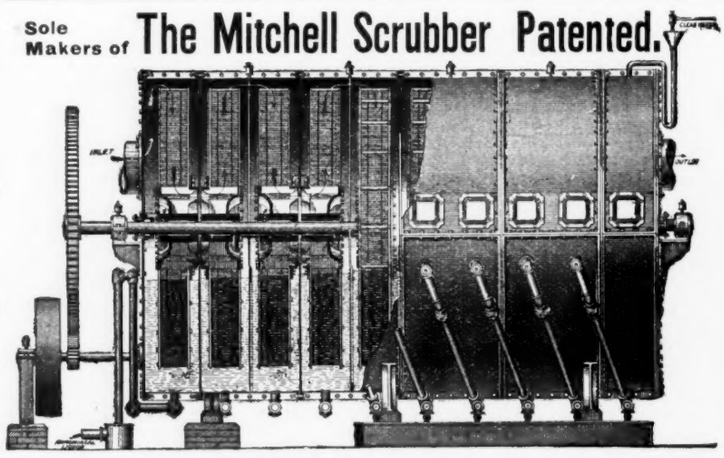

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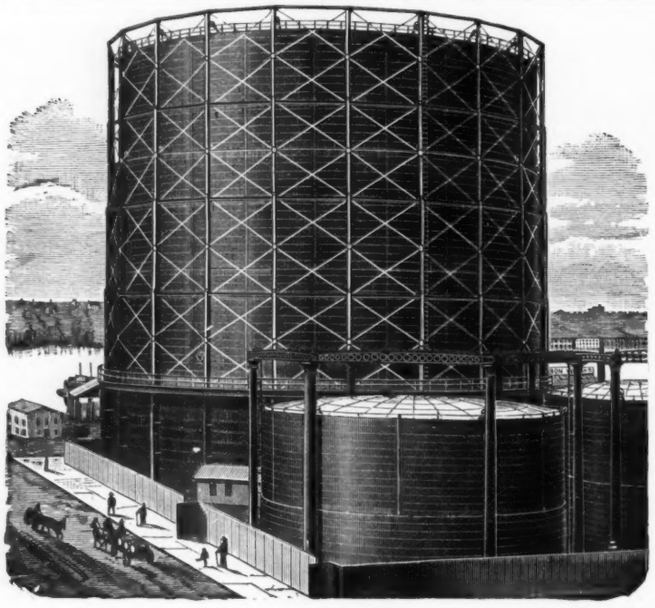

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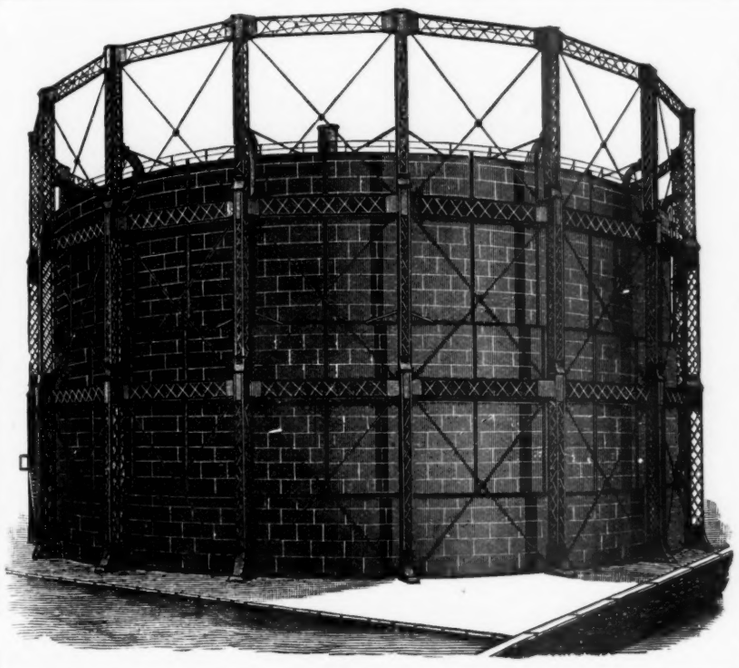

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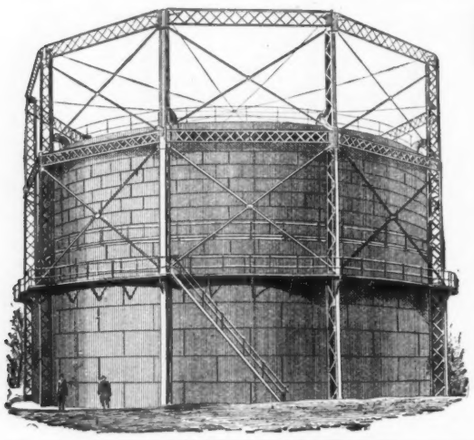

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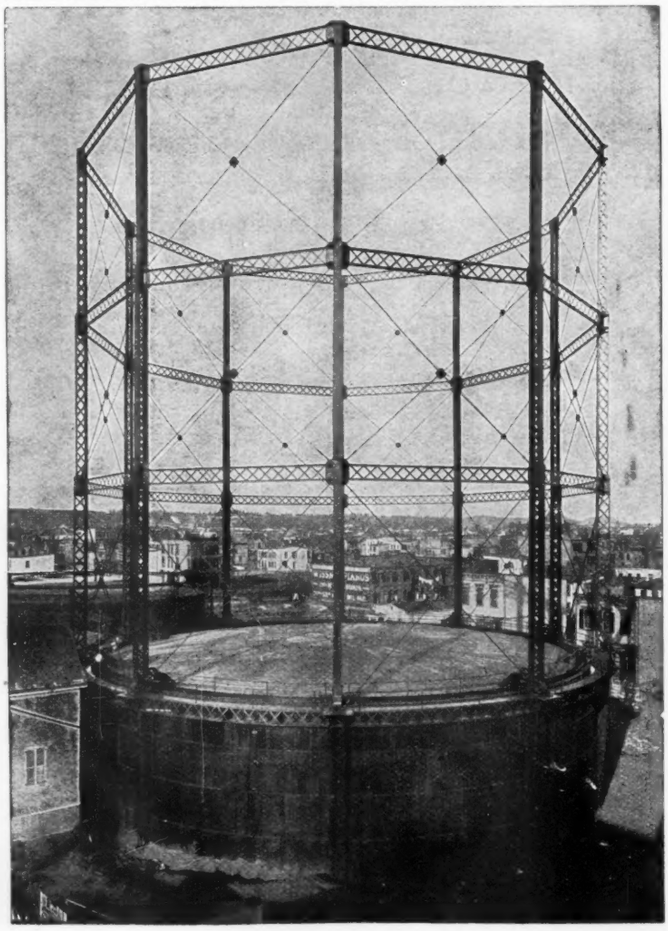

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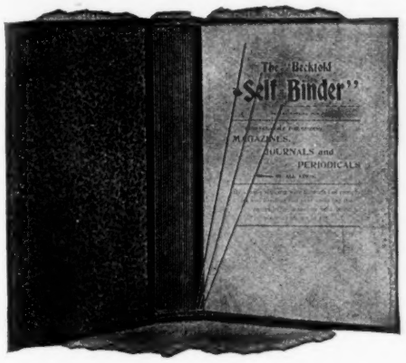

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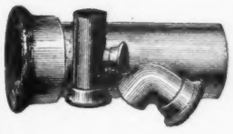

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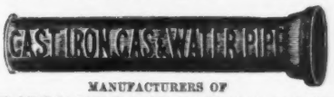

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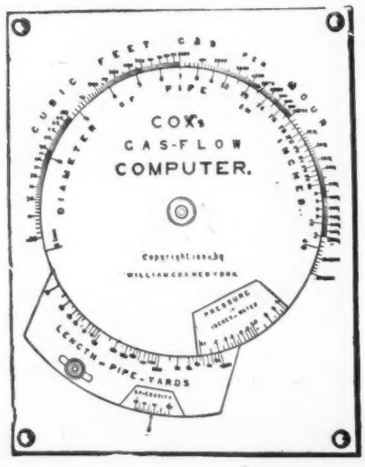

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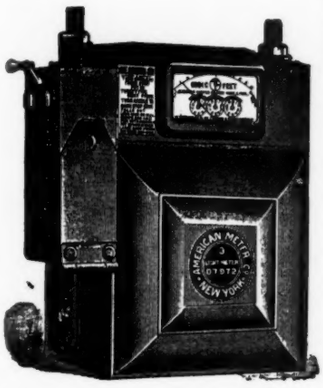

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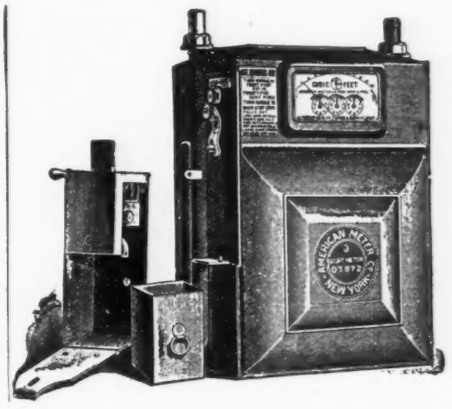

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